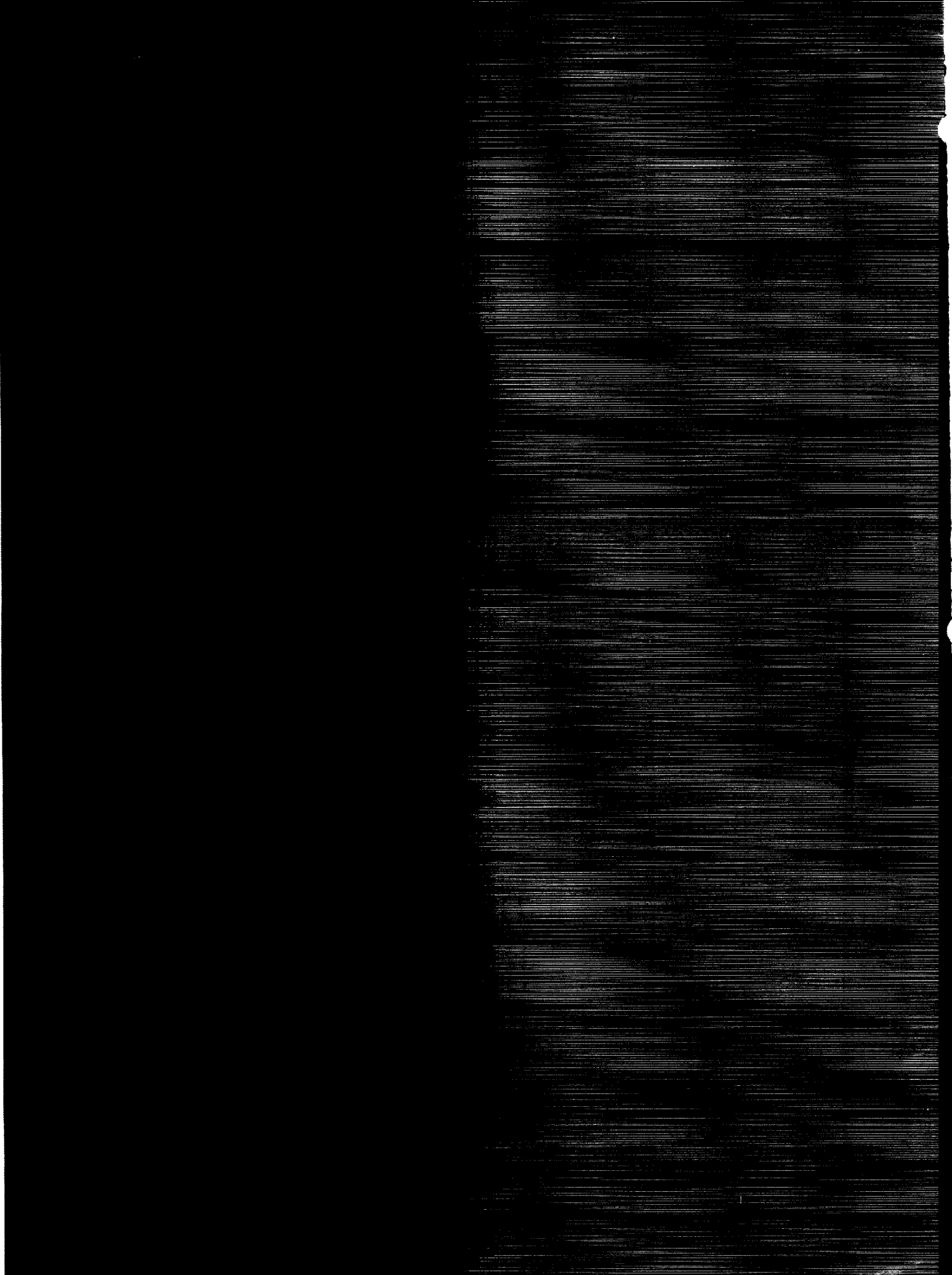


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Common Graphics Library (CGL)
Volume I: LEZ User's Guide

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September 1988

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Common Graphics Library (CGL)
Volume I: LEZ User's Guide
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How To Use This Document

Volume I documents the use of the Common Graphics Library's (CGL) Langley Easy Plot (LEZ) routines. This manual is intended to serve both as a user's guide and reference manual.

Section 1 provides an introduction to the CGL by describing its purpose and capabilities. This section acquaints the user with an overview of the New Graphics System (NGS) and reveals the significance of the Common Graphics Library.

Section 2 consists of basic terms and definitions which are used throughout the remainder of the document.

Section 3 consists of a detailed description of how to use the LEZ routines. This section is primarily intended to provide a basic understanding of the necessary calls and the appropriate calling sequences needed to generate specific chart types (line, bar, and pie).

Section 4 gives a general overview of postprocessing considerations.

Appendix A supplies a complete description of each LEZ routine, providing a description of the arguments, the routine's restrictions, and any relevant notes.

Appendix B is a collection of commented test cases accompanied with the corresponding graphics output. The examples in this section are intended to reflect some of the typical charts generally desired by various groups at Langley.

Appendix C supplies the user with the set of defaults used by the LEZ routines.

Appendix D shows the user how to access and execute the CGL on various computers.

This documentation and the initial design of the LEZ routines was modeled after the structure of the GRAFEASY User's Guide [G-7] written by Precision Visuals, Incorporated (PVI).

Glossary

ACD	Analysis and Computation Division
attribute	An inherent characteristic generally used in describing an external appearance of an entity (e.g. color, height, etc.)
bar chart	A chart consisting of rectangles with heights representing a dependent value at an associated independent position.
CDC	Control Data Corporation
character axis	An axis which has evenly spaced tick marks with text tick mark labels.
chart	A graphical representation giving information in tabular form. Plots which are "bars" are referred to as "bar charts", while plots which use "pie segments" are referred to as "pie charts".
Common Library	A subroutine library which satisfies LaRC local requirements and generates common features not supported by other graphics libraries.
composite chart	A collection of two or more charts on a single display area (terminal screen, graphics frame, etc.).
CORE	A proposed graphics standard developed by the Association of Computing Machinery's Special Interest Group on Graphics (SIGGRAPH).
defaults	A set of initial values for a set of attributes.
device driver	A device-dependent program that supports a specific graphics device. The device driver generates device-dependent output from device-independent input and handles device-dependent interaction.

device independence	The ability to control all graphics devices uniformly.
frame	A complete unit of plotting. A final figure. A page.
frame eject	A frame eject clears the display area of the selected graphics device in preparation for the next frame of picture(s).
FSGB	Flight Software and Graphics Branch of ACD
GKS	Graphics Kernel System - a graphics standard approved by ISO.
graphics session	time in which interaction with, or use of a graphics package takes place.
High-level routines	A set of routines providing an interface to generate specific chart types.
interval units	The increment between numeric major tick labels.
ISO	International Standards Organization
kernel	A subroutine library which contains all required functions for performing interactive and passive graphics tasks.
key	A list of words or phrases giving an explanation of symbols or abbreviations.
LaRC	Langley Research Center
LARCGOS	A library of locally written graphics subroutines and a set of postprocessors that drive the ACD Production Devices. LARCGOS is part of the Old Graphics System (OGS).
line graph	A graph in which points represent values of a variable for suitable values of an independent variable and are connected by line segments. Line graphs available in the Common Graphics Library include linear charts (those with linear axes) and logarithmic charts (those with logarithmic axes).

linear axis	An axis which has a linear progression of numeric major tick mark labels.
logarithmic axis	An axis which has a logarithmic progression of numeric major tick mark labels.
Low-level routines	A set of routines in the Common Graphics Library which provide graphical support in the generation of plots unique to the graphics requirements of LaRC.
metafile	A sequential file which contains the device-independent picture information necessary to produce the desired graphical output.
metafile translator	The program which interprets the device-independent metafile commands for specific physical devices
MOVIE.BYU	A graphics display system written at Brigham Young University.
NCAR	A library of graphics subroutines written at the National Center for Atmospheric Research.
NGS	New Graphics System at LaRC
NOS	Network Operating System running on Control Data computers.
OCO	Operations Control Office in Building 1268
OGS	Old Graphics System at LaRC
NASA line patterns	A set of LaRC preferred line patterns used to represent data in line charts.
NASA Logo	An emblem officially recognized by NASA.
NASA symbols	A set of LaRC preferred symbols used to represent data in line graphs.
NGS	New Graphics System at LaRC.

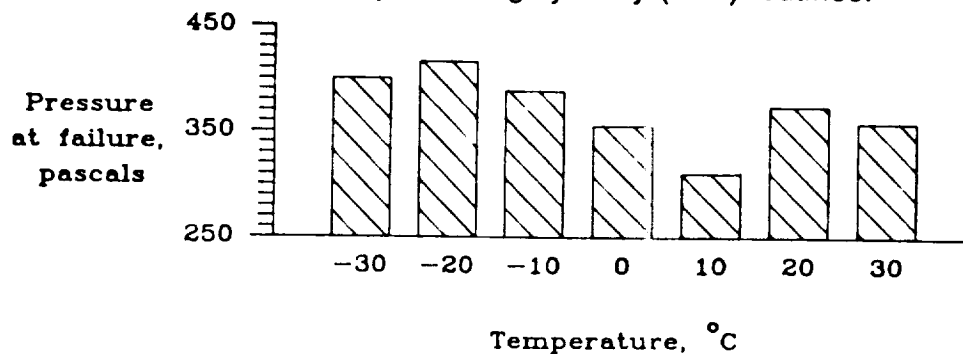
passive graphics	Graphics requiring no dynamic interaction with the display.
PC	Personal computer (e.g , IBM PC XT)
pie chart	A diagram consisting of a circle which is divided by radii, called pie segments, each of which represent a part of a whole entity.
pie segment	Section of a pie consisting of an area swept out by a radius.
pixel	The smallest unit available for display on a raster screen, representing a single graphics point.
post processor	A device-dependent program that drives an ACD production device.
PRIMOS	PRIME Operating System
production devices	Batch graphics output facilities at the central site; includes Calcomp, Varian, and Versatec.
publication standards	A set of requirements describing the appearance and contents of plots which must be satisfied for use in technical documents published through the NASA publication process.
PVI	Precision Visuals, Incorporated
scale factor	The change in value per scale increment.
scale origin	The beginning lower scale value. This is usually the minimum value or an adjusted minimum value.
selected graphics device	A graphics device which is enabled to receive graphics output or to send graphics input.
tick mark	Short lines at specified intervals denoting grid.
viewgraph standards	A set of requirements describing the appearance and contents of plots which must be satisfied for use in audience presentations.

workstation	An abstract logical unit consisting of zero or one display surface and zero or more input devices.
2D	Two-dimensional
3D	Three-dimensional

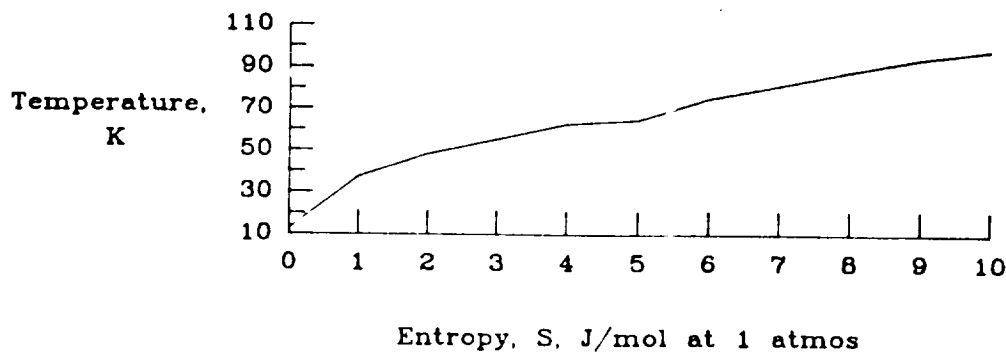
1. Introduction

The Common Graphics Library (CGL) enables the user to generate charts conforming to the unique graphics requirements at NASA LaRC. This section will identify these requirements, describe the purpose of the CGL, and provide an overview of the library's structure and capabilities.

The CGL offers various levels of operation ranging from powerful, easy to use, chart making routines, to special purpose routines for specific applications. One of the chief considerations in the design of the CGL was the capability of generating publication quality charts requiring a minimal of effort. Figure 1-1 shows the three basic chart types generated by the Langley Easy (LEZ) routines.



a) Low pressure fatigue of Superalloy



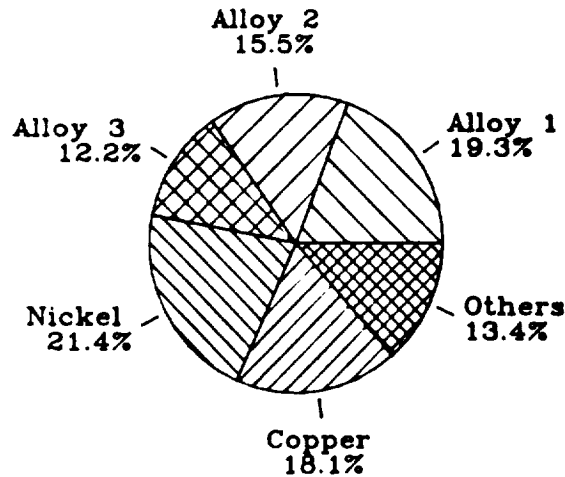
b) Temperature vs. entropy for Superalloy

Figure num. Characteristic charts for Superalloy

CGMIX3

Figure 1-1. The three basic LEZ chart types.

a) Bar chart; b) line chart.



c) Composition of Superalloy

Figure num. Concluded

Figure 1-1. Concluded.

c) Pie chart.

1.1 LaRC's Unique Plotting Requirements

The graphics requirements at LaRC are very diverse in nature, reflecting the diverse variety of applications (business, CAD/CAM, engineering, and scientific, etc.) present at NASA Langley. The CGL and this manual concentrate on 2D chart generation. These types of charts include: line/logarithmic charts, bar charts, and pie charts. See section 2 for a description of each chart type.

The format of these computer-generated charts must conform to various criteria depending on where and how the charts are to be used. Several types of journals and technical papers require that the charts are acceptable to the Langley publication process. The remainder of this subsection will provide only the basic characteristics of this criteria, whereas a complete description can be found in "Guidelines in Preparing Computer-Generated Plots for NASA Technical Reports with the LaRC Graphics Output System" [G-2].

A fundamental intent of the CGL is to provide a set of primitive routines unique to LaRC. These requirements partially consist of: the NASA line patterns, the NASA symbols, and the NASA logo.

The NASA line patterns consist of the following eight line patterns in the following sequence:

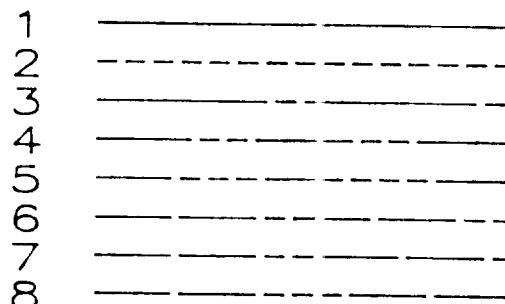


Figure 1-2. NASA standard line patterns.

The NASA symbols consist of the following symbols in the following sequence:

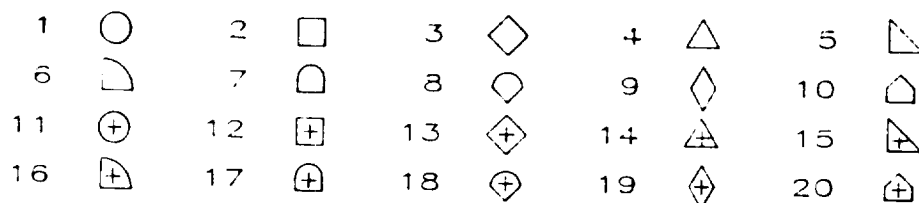


Figure 1-3. NASA standard symbols.

If a flag is desired, add 100, 200, 300, ..., 800 to the base symbol number. Note, symbols one through ten are recommended for publication quality plots.

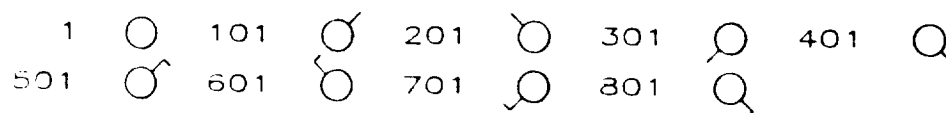


Figure 1-4. NASA standard symbols with flags.

If a solid filled symbol is desired, add 900 to the base symbol number. Note, however, the use of solid filled symbols is not desirable for publication quality charts.

901 ●

Figure 1-5. NASA standard symbols - solid filled.

The NASA logo is an emblem officially recognized by NASA. The policy governing the use of the NASA logo is documented in the NASA Management Manual (NMI 1020.1G Paragraph 13b).



Figure 1-6. NASA logo.

In addition to these primitives, the page layout and the contents of the charts must conform to the criteria determined by the chart's intended audience. For example, the sizes and distances between various chart elements must be sufficient to provide a clear and legible chart.

The intent of the publication quality standard is to ensure that charts will consistently be published legibly with no loss of integrity. As such, a set of publication parameters are defined that control the size of the characters used for labeling, the distances to the labels, the distances between lines and columns, the length of tick marks, and the symbol sizes.

The use of viewgraph standards ensures that charts being presented to a group will show the data clearly and legibly.

A complete description of the publication quality standards can be found in the NASA TM 81908 ("Guidelines in Preparing Computer-Generated Plots for NASA Technical Reports") [G-2].

1.2 Purpose of the Common Graphics Library

A commercially developed general purpose graphics package is typically designed for the graphics user community at large as opposed to being tailored toward a specific set of restrictions such as those proposed by LaRC. Thus, LaRC's requirements necessitated the development of a Langley specific graphics library, the COMMON GRAPHICS LIBRARY (CGL). This library is accessible from all New Graphics System software components providing an easy means of supplying these requirements.

The purpose of the Common Graphics Library is to supply the users with a set of application independent primitives which satisfy LaRC's unique graphics requirements, enable the user to view data quickly and easily, and provide a means of generating charts conforming to the publication and/or viewgraph process. Thus, the spacing and distancing between various components is inherently based on these prescribed values. This feature supports the user in the generation of publication quality charts, while minimizing the necessity of cumbersome formatting details.

1.3 The Structure and Capabilities of the Common Graphics Library

The CGL consists of two levels, a set of generalized, High-level (Langley Easy, or LEZ) routines, and a set of specific, Low-level routines (see figure 1-7). These two levels reflect the degree of sophistication both in terms of difficulty of use, and provided capabilities.

The Low-level routines control individual chart components, such as an axis, a key, or a data line. The user pieces together these components to construct a desired chart. This set of routines works directly with the underlying graphics package, and thus fires the user to be familiar with that package. Since the user is constructing a chart, the user has a greater range in the diversity of charts to be generated. However, this diversity is offset by a greater programming effort.

The Langley Easy (LEZ) Plot routines, also referred to as High-level routines, control aspects of an entire chart. The LEZ routines call all necessary Low-level routines to produce a given chart type for the user. The user then controls the characteristics of the chart components. The High-level routines provide a method of quick and easy chart generation with an emphasis on publication and/or viewgraph quality linear/logarithmic charts, bar charts, and pie charts. Thus, the user is relieved of the responsibility of learning the details of the underlying general purpose graphics package, and much of the details of the publication and

viewgraph quality standards. The only details needed from the user pertain to the user's desired chart. By using the High-level routines, the user modifies a selected chart type through an abundant set of options. Although these options provide a wide diversity of chart configurations, the amount of effort needed to generate them is minimal. It should be noted that the LEZ routines can be used in conjunction with the Low-level routines to further enhance the basic charts created with the LEZ routines.

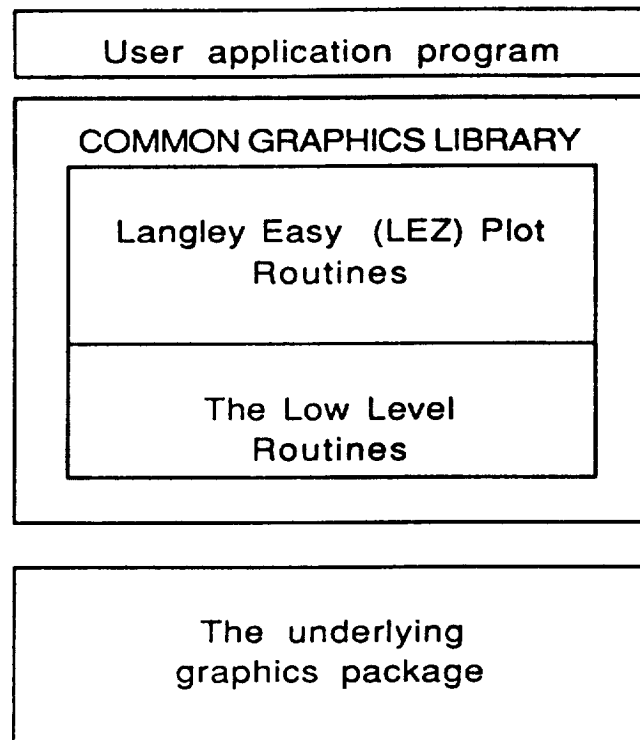


Figure 1-7. Structure of the Common Graphics Library from an application viewpoint.

1.4 Common Graphics Library's Prominence in the New Graphics System (NGS)

The Common Graphics Library is a FORTRAN user-callable library which can be used independently or in conjunction with other graphics packages. This subsection is intended to briefly describe how the Common Graphics Library is related to NGS. The Graphics MINI Manual [G-1] identifies and describes the various graphics software and hardware components, details the interfaces between these components, and provides information concerning the use of these components at LaRC. The user is strongly recommended to read the Graphics MINI Manual to obtain an overview of the various graphics capabilities currently available in the NGS. Figure 1-8, the NGS hierarchy structure, shows the major graphics software packages and hardware devices currently supported.

As previously described, the Common Graphics Library consists of LEZ routines (High-level) and Low-level routines. The Low-level routines interface with the underlying graphics package directly, and are intended as an extension to this package by supplying chart components (e.g. axes, symbols, lines, patterns, etc.). This level of sophistication enables the software packages which are functionally higher in the hierarchy to utilize these capabilities. To interface the CGL with other graphics packages, the user must either directly modify the package calling the CGL or use the CGL in conjunction with the calling package adhering to the constraints of both packages.

The LEZ routines provide a degree of sophistication which is intended to be used as a stand-alone package. Although these routines use the Low-level routines internally, the Low-level routines can also be called by the user to augment the LEZ routines graphics output.

1.4.1 The Underlying Graphics Package

Currently, DI-3000 is the application independent, underlying graphics package serving as a primary component of the CGL. The LEZ routines provide an abstract interface which is "commercial graphics package independent". This implies that the calling sequence and arguments supplied to the LEZ routines do not rely on a specific underlying graphics package. This independence is conducive to future transitions of the LEZ routines from DI-3000 to another underlying graphics package (e.g. GKS).

The Low-level routines, however, interface with DI-3000 directly and are therefore "context sensitive" (i.e., must conform to the requirements of "where" and "how" the graphical components can be created and generated). Additionally, the capabilities of the Low-level routines depend heavily upon the primitives and attributes present in the underlying graphics packages (e.g., color, character, fonts, interim line patterns, etc.).

USER DEVELOPED

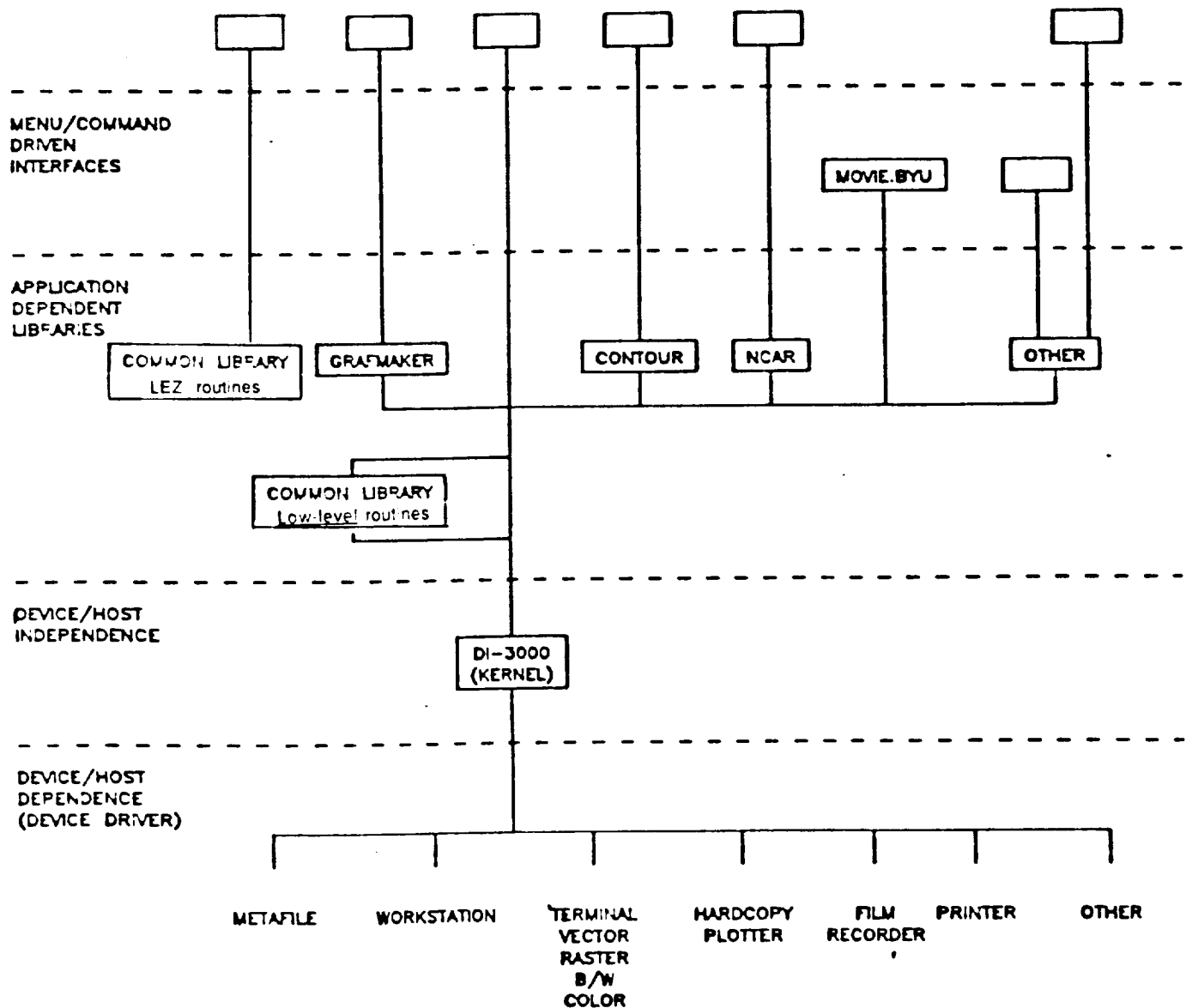


Figure 1-8. NGS hierarchy structure.

1.4.2 The Device Drivers

The following explanation of the relationship of the device drivers to the NGS hierarchy is intended as an overview. The user is referred to the Graphics Mini Manual [G-1] for a more detailed description.

Each of the NGS software components interface to a hardware device through a device driver. A DI-3000 device driver is a collection of device specific subroutines that drive a particular display device. A separate DI-3000 device driver is associated with each graphics output device. A special device driver, the metafile driver, produces a file of device independent graphics information that may be processed by the METAFILE TRANSLATOR [G-6]. The features of each device driver are documented in a Device Driver Guide (DDG) [G-10]. Although the device driver is linked at load-time, the user must initialize, select, and perform other device action from within the application program. Each device is assigned as an integer number. For load-time device selection, the metafile driver is assigned "0" and any other device is assigned "1".

Since the LEZ routines are not restricted to a specific general purpose graphics package, but provides an abstract interface, the following call selects and initializes the identified device(s):

CALL LEZINI (IDEV)

where IDEV is the assigned device name (0-metafile; 1-Interactive device; 2-both metafile and interactive device). Note, this routine can be called again to select and deselect specific devices. A complete description of selecting and initializing the underlying graphics package from the LEZ routines can be found in Appendix A in the description of LEZINI.

In the case of the Low-level routines of the CGL, the device driver must be selected and initialized with the following DI-3000 calls

CALL JDINIT (IDEV)
CALL JDEVON (IDEV)

where IDEV is the assigned device number (0-metafile; 1-interactive device). A complete description of selecting and initializing DI-3000 can be found in the DI-3000 User's Guide [G-5].

1.5 Planning Figures for Publication

It is a common practice that most of the figures in NASA reports are grouped together at the end of the report instead of inserted in the text; therefore, all figures should be as uniform as possible. However, authors are instructed to discuss requirements with the editors if they want figures integrated in the text. The basic rules to follow in planning uniform figures are:

1. The chart perspective should be read from one point; the person reading the charts should not have to rotate the paper to read the charts. The one exception to this rule is a long vertical label.
2. The plot areas should be kept the same size and the charts should be oriented the same throughout the report.
3. The same scale per unit value (scale increment) should be used on similar data, even if the data are in different ranges. For example, a scale increment, for an angle should remain the same even if the range is 0 to 90 for one chart and 90 to 180 for another chart.
4. The vertical figure orientation (see figure 9) is preferred. The vertical measurement is 9 $\frac{3}{16}$ inches (233.4 mm) and the horizontal measurement is 7 $\frac{1}{8}$ inches (181.0 mm).
5. The horizontal figure orientation (see figure 10) is not preferred because the report must be physically rotated to view the figure, but there are times when the data necessitates using the horizontal figure. The horizontal measurement is 9 $\frac{3}{16}$ inches (233.4 mm) and the vertical measurement is 7 $\frac{1}{8}$ inches (181.0 mm).
6. All labeling within the plot area should be the same size even if the figure is divided into multiple parts. If a figure is divided into multiple parts, the height of the full-size character for labeling is based on the size of the whole figure, not each separate part.
7. Horizontal axis should represent independent data, vertical axis should represent dependent data.
8. Character heights should be $\frac{1}{4}$ greater than widths (or conversely width should be .8 of height).

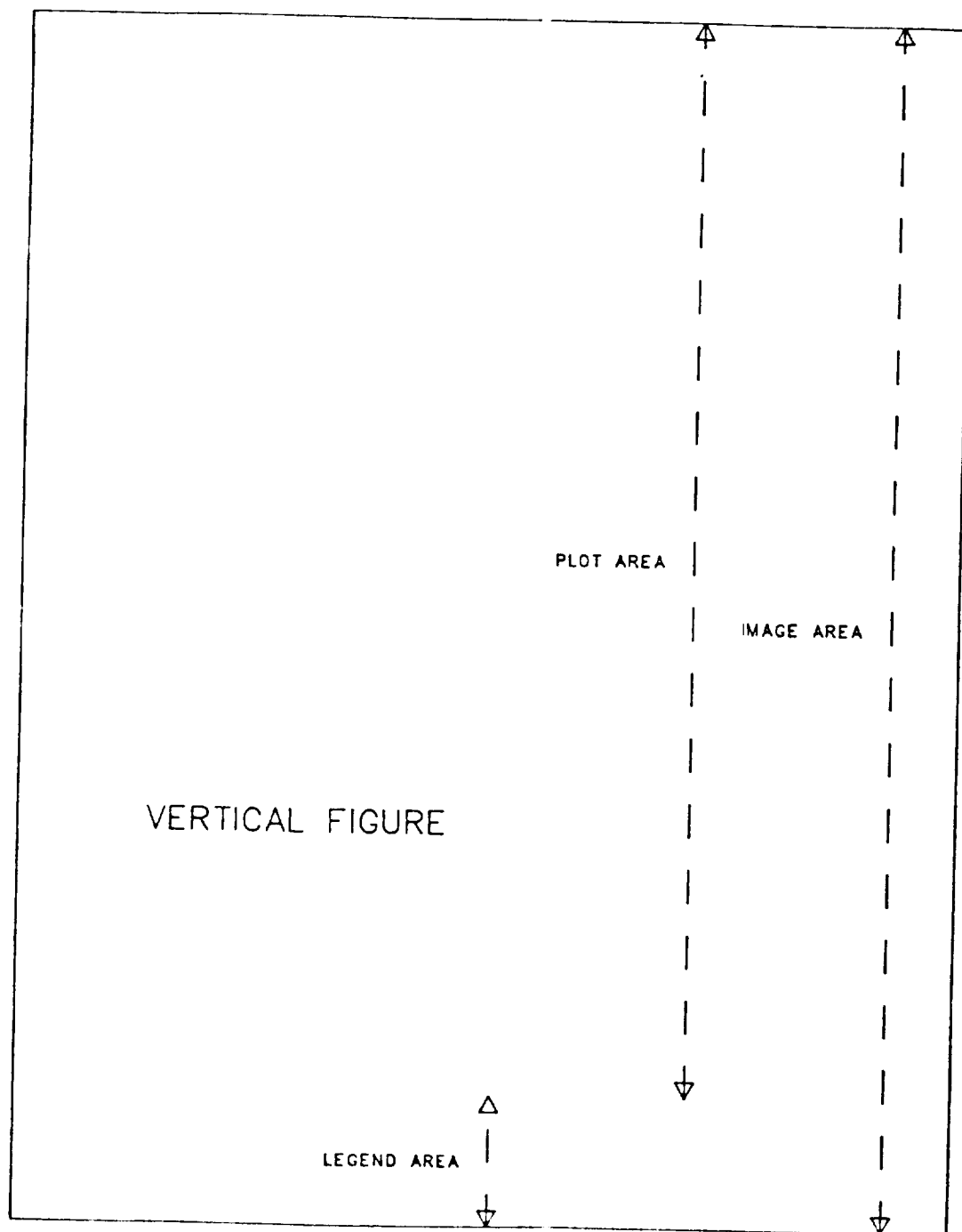


Figure 1-9. Vertical figure orientation.

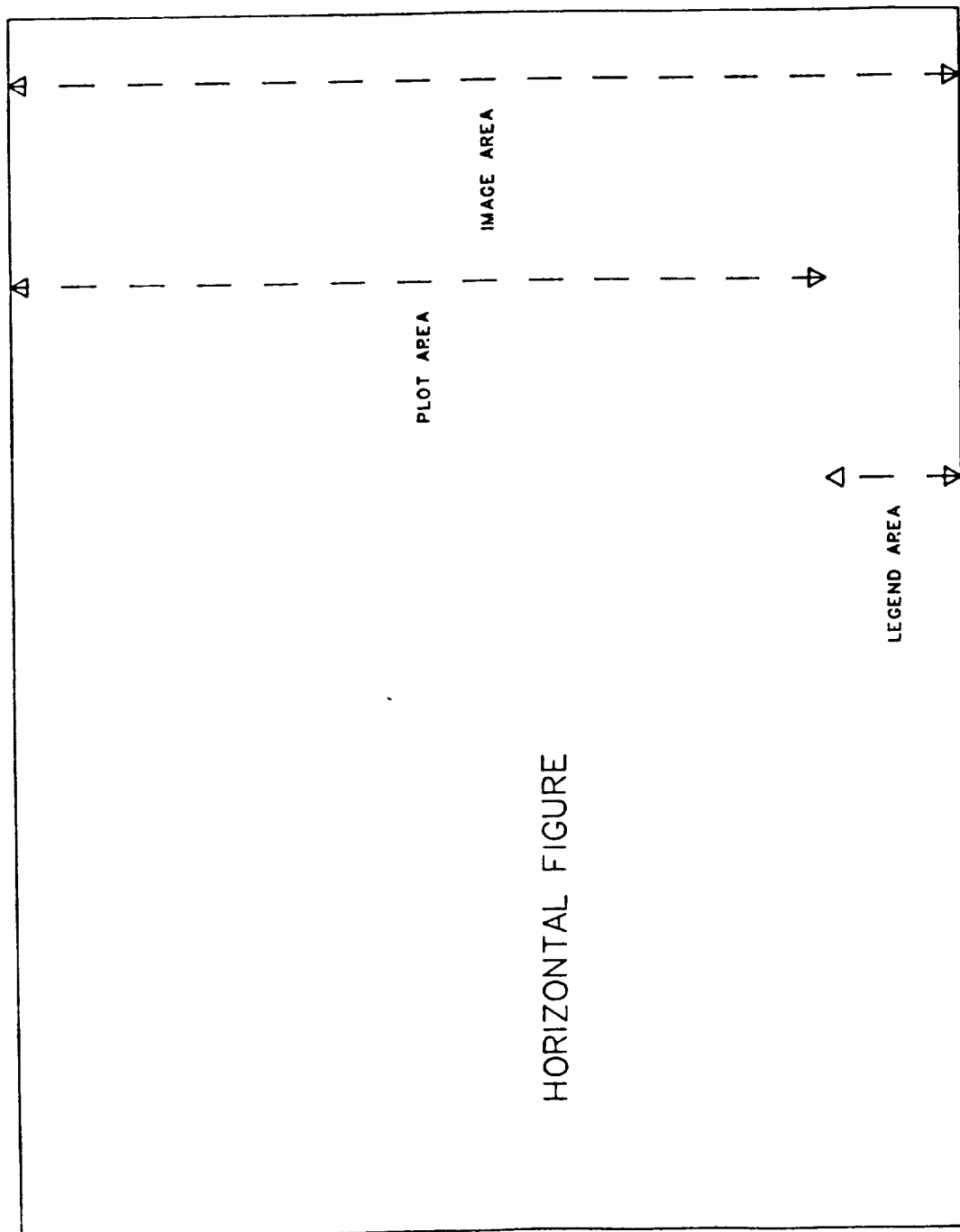


Figure 1-10. Horizontal figure orientation.

1.6 The Use of the CGL for Publication Purposes

The Common Graphics Library provides a method to obtain publication and viewgraph quality charts. By default, the CGL will conform to publication quality standards by providing:

- appropriate sizes and distances between various chart components;
- data curves using lines and symbols, such that the line does not pass through the symbols;
- text attributes suitable to acceptable publication standards; and
- appropriate distancing between tick mark labels and the axes.

Because the CGL defaults to the use of these NASA standards, the user is required to have a minimum knowledge of the actual specifications needed to obtain these charts. However, the user is responsible for using the library in such a way as to stay within the criteria of the publication process. The user should ensure:

- that user defined text heights and widths are acceptable;
- appropriate capitalization of text to conform to standards;
- the numeric tick mark labels have suitable scale factors;
- that text does not overwrite other components (and/or text); and
- appropriate content for the audience's clarity.

The CGL does provide assistance in dealing with some of these considerations.

Notes.

2. Basic Concepts and Terminology

This section provides an overview of the various types of charts and identifies and illustrates their various components. This section is intended as a reference only. Conceptually, this section begins with the more abstract concepts and decomposes them into smaller, more refined elements.

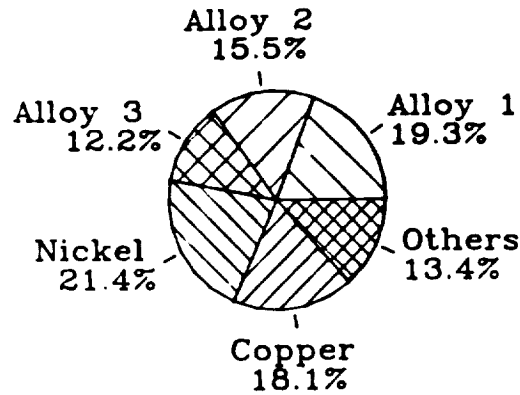
2.1 The Terms Chart and Plot

The terms chart and plot are often used interchangeably, but have subtle differences depending on the context in which they are used.

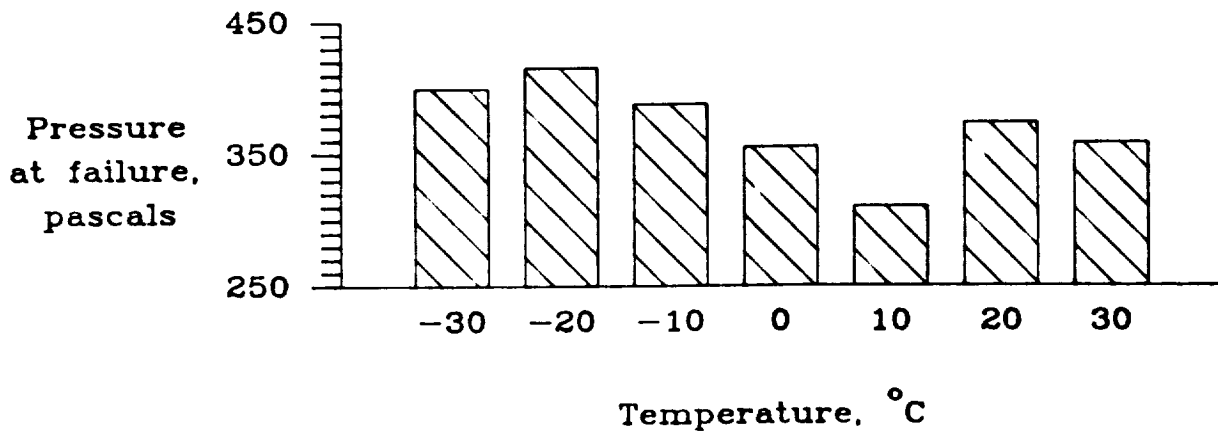
chart - a diagram (is a series of one or more symbols, lines, line segments, curves, tabular data, or areas) that represent the variation of a variable in comparison with that of one or more other variables. Charts which depict linear data are referred to as "line charts" or "linear charts". Charts which depict logarithmic data are referred to as "log charts" or "logarithmic charts". Charts which use "bars" are referred to as "bar charts", while plots which use "pie segments" are referred to as "pie charts". There are three basic chart types: linear/logarithmic charts, bar charts, and pie charts (see figure 2-1). Each type is explained in a following subsection, and concepts specific to each are detailed.

plot - one or more charts on a single display area (terminal screen, graphics frame, etc.). Thus, "plot" is used interchangeably in this document as a generic term for "chart".

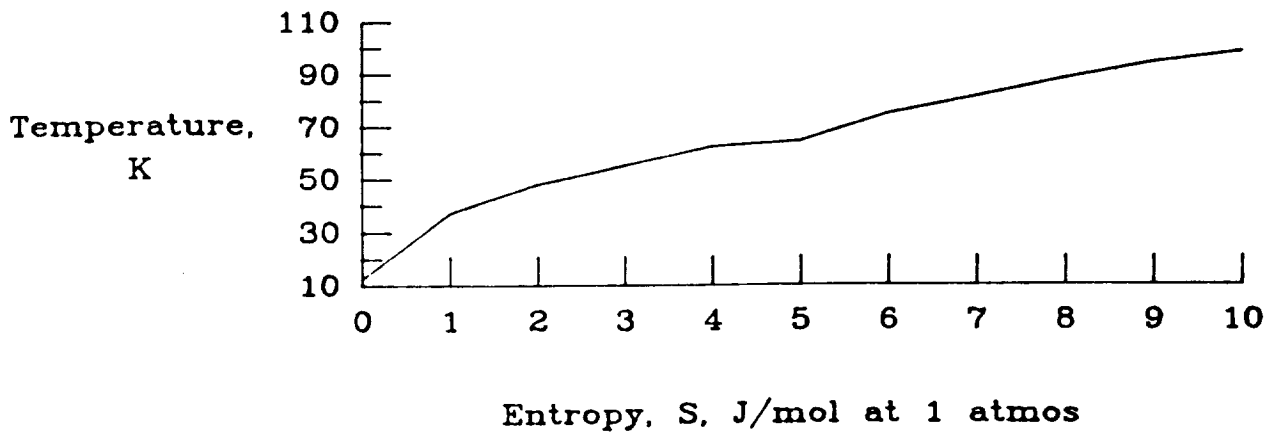
composite chart - a collection of two or more charts on a single display area (terminal screen, graphics frame, etc.).



a) Composition of Superalloy



b) Low pressure fatigue of Superalloy



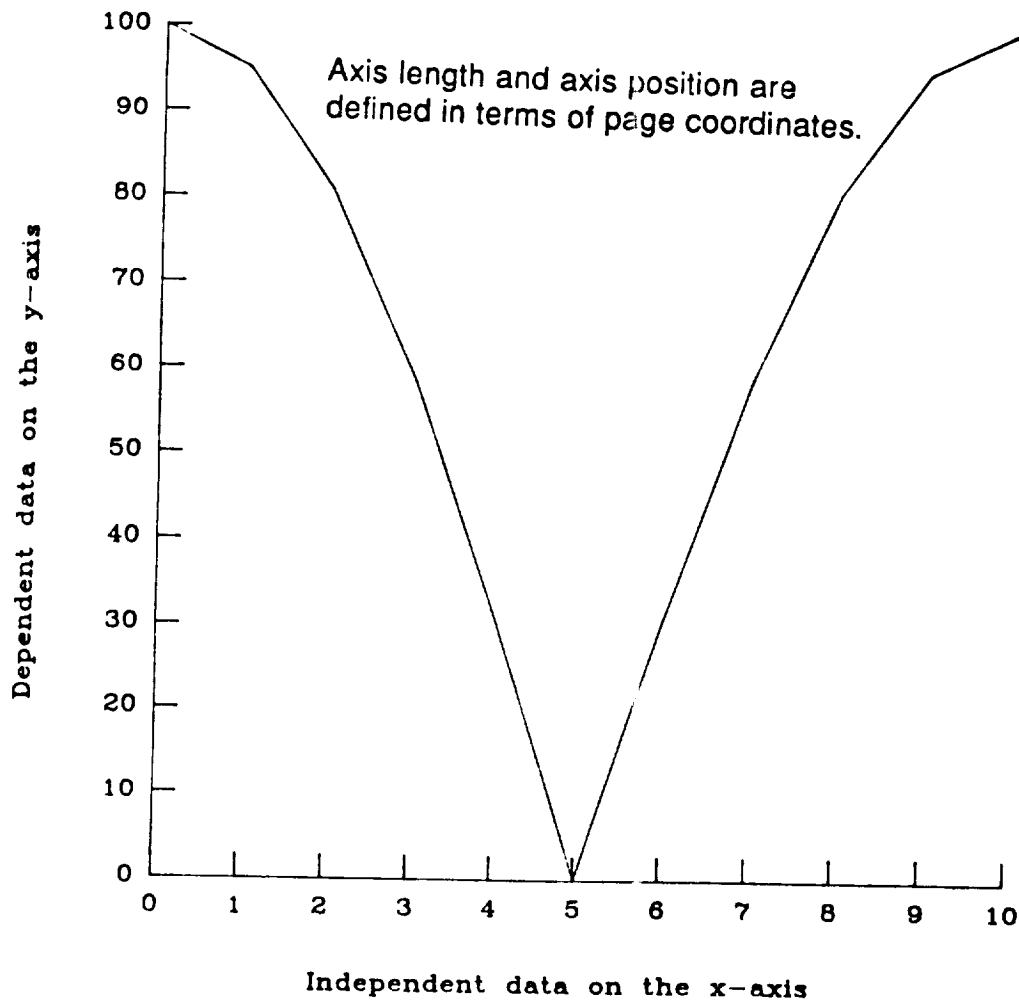
c) Temperature vs. entropy for Superalloy

Figure num. Characteristic charts for Superalloy
 Figure 2-1. The three basic LEZ chart types.
 Linear chart (bottom); bar chart (middle); pie chart (top).

CGMIX1

2.2 Coordinate Systems

page coordinates - The CGL routines allow the user to define a coordinate system in which all charts, and their components can be described. This system provides a unit of measure allowing the user to establish lengths, and distances (e.g., axis length, axis positioning, etc.). This coordinate system is referred to as page coordinates (or page space). The units used to describe the page boundaries (or page size) can be determined by the user, and can represent any unit of measure the user wishes. If the user is going to send the charts to a postprocessing device, a compatible unit of measure is desirable (e.g., inches or millimeters).

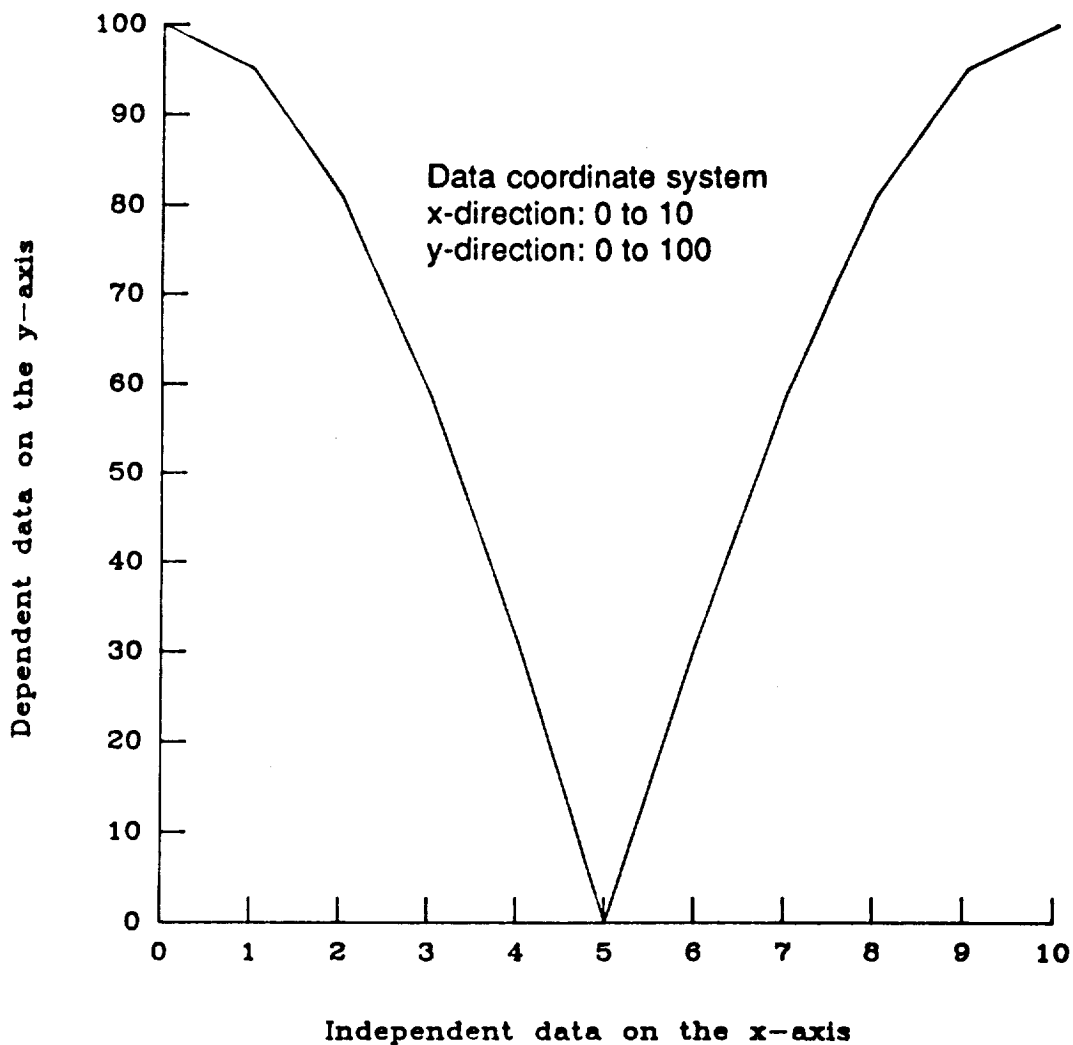


Plot of $y = |100\cos 18x|$

Figure 2-2. Page coordinates.

DCLIN1

data coordinates (or data space) - The CGL routines allow the user to define a coordinate system in which the data is to be plotted. The user controls the range and values of the data coordinate system through calls to the appropriate routines. The data coordinates only affect how and where the data is to be plotted on the page. If data to be plotted lies outside the data space, then those data values will be clipped (i.e., not plotted). The location of the data coordinate system is determined by the boundaries formed by a set of axes (two or more).



Plot of $y = |100\cos 18x|$

DCLIN1

Figure 2-3. Data coordinates.

2.3 Linear/Logarithmic Charts

A linear/logarithmic chart is a diagram which uses a series of one or more symbols, lines, line segments, and/or a combination of these to represent data. For a linear chart, the scale factor (i.e., the change in values between major tick marks) progresses in a linear fashion. For a logarithmic chart, the scale factor progresses in a logarithmic fashion.

Charts are further classified based on the scale factors for the dependent and independent axes:

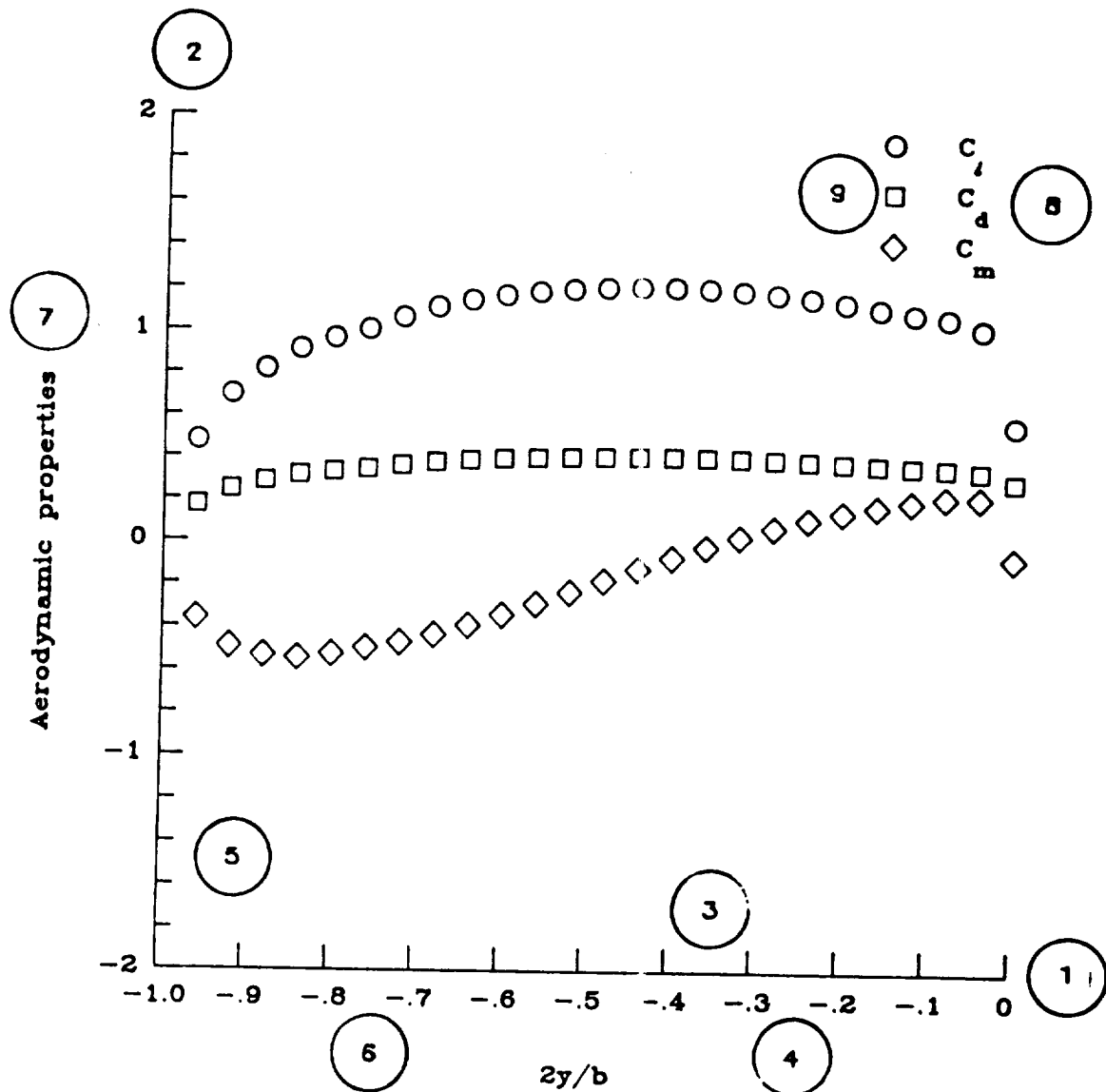
- | | |
|-------------------|---------------------------------------|
| linear chart | - both axes are linear |
| logarithmic chart | - both axes are logarithmic |
| semi-log chart | - one axis is linear and logarithmic. |

The LEZ line plotting routines will generate publication and/or viewgraph line charts with the NASA line patterns and symbols. When a data curve is represented with both lines and symbols, the LEZ routines will display the data with the line not passing through the symbol. The user may plot linear, logarithmic, or logarithmic-linear charts. The LEZ line routines offer a key which provides additional information about the data in the chart. By the use of unique line patterns and symbols, it is possible to plot a family of curves which can clearly be seen either on a color viewgraph, or on a black and white printed report.

- 1) horizontal axis -
the axis parallel to the bottom of the figure orientation when viewing the page from the intended perspective. The horizontal axis usually represents the independent data.
- 2) vertical axis -
the axis parallel to the side of the figure orientation when viewing the page from the intended perspective. The vertical axis usually represents the dependent data.
- 3) major tick mark -
short lines at specified intervals perpendicular to the axis being denoted.
- 4) major tick mark labels -
a character or numeric description associated with a major tick mark. Often referred to as "tick mark labels".
- 5) minor tick marks -
short lines between major tick marks perpendicular to the axis being denoted.
- 6) scale factor -
the change in value between numeric major tick marks.
- 7) axis label -
a text string describing the properties associated with an axis.
- 8) key -
a block of information placed within the page boundaries, explaining any codes or symbols used on the chart. The placement of the key, of a particular chart, is based on the justification about the key position (an XY page coordinate). For example, a justification of upper right will position the upper right corner of the key at the position denoted by the key XY location.

UL	-----	UR
LL	-----	LR
- 9) key entry -
a line consisting of a description associated with a symbol and/or line.
- 10) caption -
the figure number and title. Often referred to as a chart title.

The following figure illustrates the various components of linear/logarithmic charts.



Vortex flow about a 60° delta wing with $\alpha = 20^\circ$ (10)

CGLIN1

Figure 2-4. Linear/logarithmic chart components.

2.4 Bar Charts

A bar chart is a diagram which uses a series of rectangles. The height of each rectangle represents a dependent value at an associated independent position.

The charts may be represented in an absolute manner (side by side) contrasting the data distinctly. The charts may be represented in an additive manner (stacked) showing their cumulative properties. A key option can be used to provide additional information concerning multiple data sets.

1) horizontal axis -

the axis parallel to the bottom of the figure orientation when viewing the page from the intended perspective. The horizontal axis usually represents the independent data.

2) vertical axis -

the axis parallel to the side of the figure orientation when viewing the page from the intended perspective. The vertical axis usually represents the dependent data.

3) major tick mark -

short lines at specified intervals perpendicular to the axis being denoted.

4) major tick mark labels -

a character or numeric description associated with a major tick mark. Often referred to as "tick mark labels".

5) minor tick marks -

short lines between major tick marks perpendicular to the axis being denoted.

6) scale factor -

the change in value between numeric major tick marks.

7) axis label -

a text string describing the properties associated with an axis.

8) key -

a block of information placed within the page boundaries, explaining any codes or symbols used on the chart. The placement of the key, of a particular chart, is based on the justification about the key position (an XY page coordinate). For example, a justification of upper right will

position the upper right corner of the key at the position denoted by the key XY location.

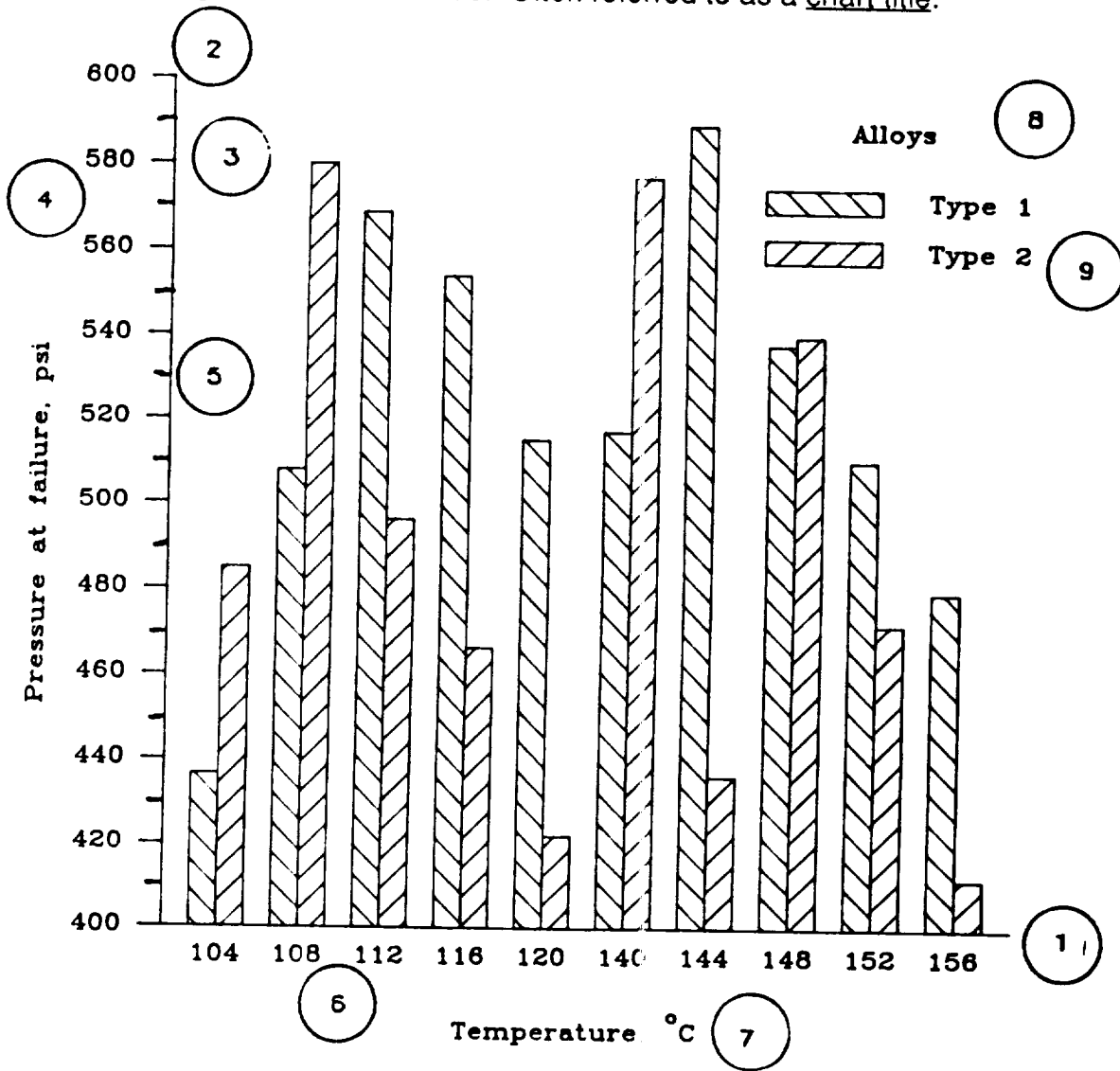
UL-----UR
 |
 LL-----LR

9) key entry -

a line consisting of a description associated with a symbol and/or line.

10) caption -

the figure number and title. Often referred to as a chart title.



Low pressure fatigue testing 10

Figure 2-5. Bar chart components.

DCBAR5

2.5 Pie Charts

A pie chart is a diagram consisting of a circle which is divided by radii, called pie segments, each of which represent a part of a whole entity. The following figure illustrates the various components of a pie chart. The LEZ pie chart routines generate a plot which will show the relativity of the components of a certain entity. Pies are most often used in showing the "percent of" or "composition of" a particular item.

The pie chart routines offer the capability of computing and showing the percentage labels, quantity labels, and/or text labels for each segment. A key option can be used to provide additional information.

- 1) radius -
the length of a line segment extending from the center of a pie segment to the pie segment circumference.
- 2) origin -
the center of the pie.
- 3) pie segment -
a wedge-shaped polygon representing a percentage of the entire pie.
- 4) pie segment text label -
a description associated with a pie segment.
- 5) pie segment quantity label -
the actual value of which the segment represents.
- 6) pie segment percentage label -
the percentage of the pie which the segment denotes.
- 7) key -
a block of information placed within the page boundaries, explaining any codes or symbols used on the chart. The placement of the key, of a particular chart, is based on the justification about the key position (an XY page coordinate). For example, a justification of upper right will position the upper right corner of the key at the position denoted by the key XY location.

```
UL-----UR
|
|
LL-----LR
```

8) key entry -

a line consisting of a description associated with a symbol and/or line.

9) caption -

the figure number and title. Often referred to as a chart title.

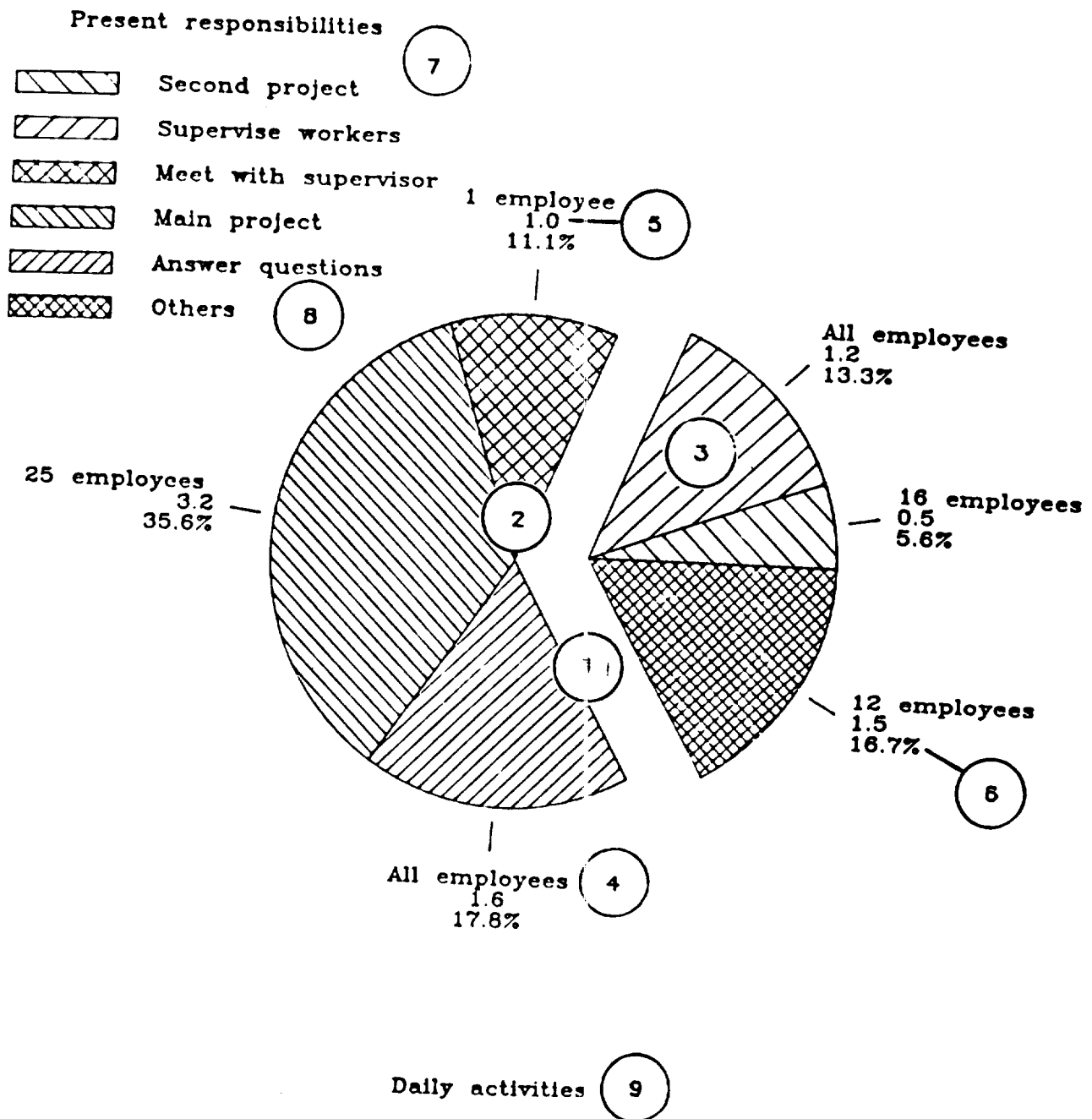
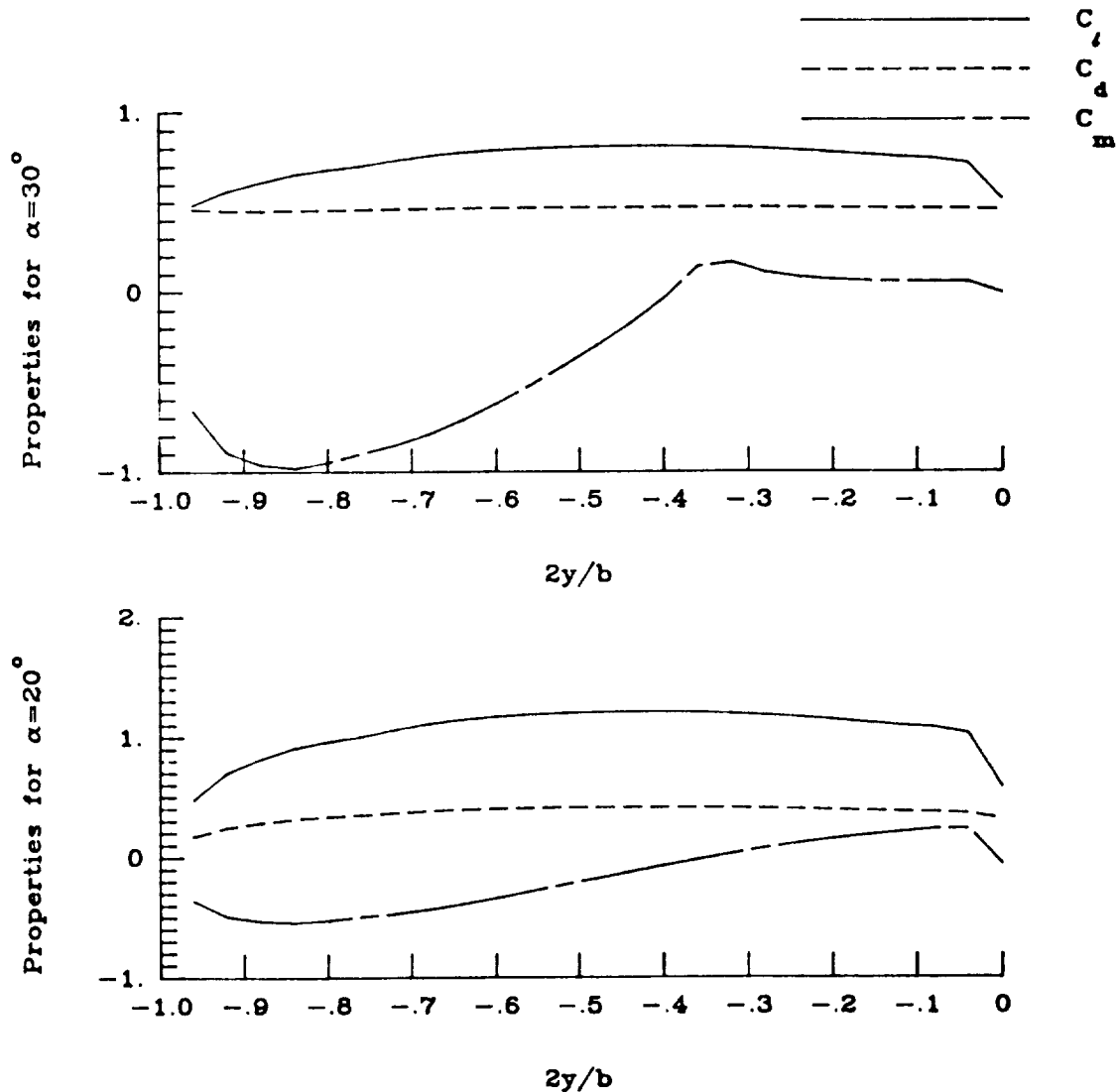


Figure 2-6. Pie chart components.

2.6 Composite Charts

The LEZ routines can easily generate multiple charts per page, hereafter referred to as **composite charts**. The number and type of charts that can be placed on a page is limited only by the user-definable page size. It is possible to have the three available chart types appear on the same page. The generation of composite charts utilizes most of the options available in the LEZ options routine (LEZOPT).



Vortex flow about a 60° delta wing

DCMX1

Figure 2-7. Example of a composite chart.

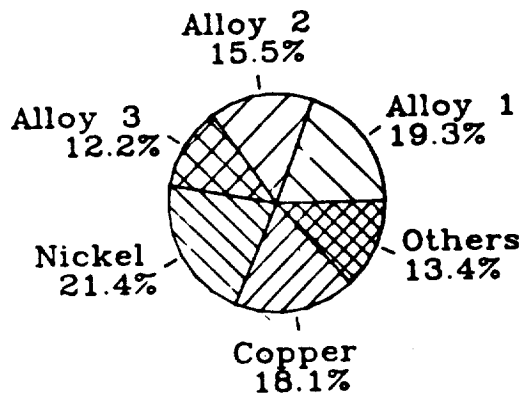
3. LEZ ROUTINES

3.1 Introduction

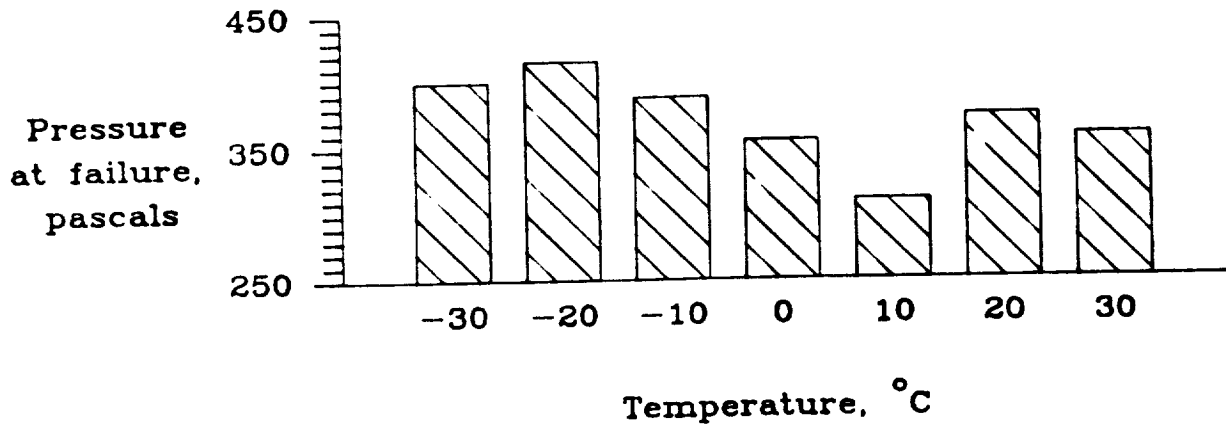
The LEZ routines provide the capability of generating charts using a minimal set of subroutine calls. The LEZ routines provide line, logarithmic, bar, and pie chart capabilities. The primary emphasis offered by the LEZ routines is the linear or logarithmic line charts which use the NASA line patterns and point symbols, and conform to NASA/Langley's publication and/or viewgraph specifications. Additionally, there are several options available for enhancing charts while minimizing the need to rewrite code. The LEZ routines provide the capability of making composite (multiple charts per page) charts easily. The required interfaces needed to run the underlying graphics package and to interface with LaRC's plot devices are also provided.

In addition to the CGL providing publication quality plots and requirements unique to LaRC, it also provides an extremely simple and easy way to generate charts. The LEZ routines provide a set of defaults which will yield charts which implicitly conform (with little or no modifications) to the publication standards. The effort of the library to ensure these standards are met, also ensures that less stringent requirements will be easily satisfied (e.g., "quick and dirty plot"). Besides serving the LaRC requirements, the LEZ routines offer desirable features which benefit the user in the generation of practical charts. As a result of a little effort, the user can easily generate three basic types of charts: linear/logarithmic, bar, and pie. These basic types can be combined onto a single frame to provide a composite chart if desired.

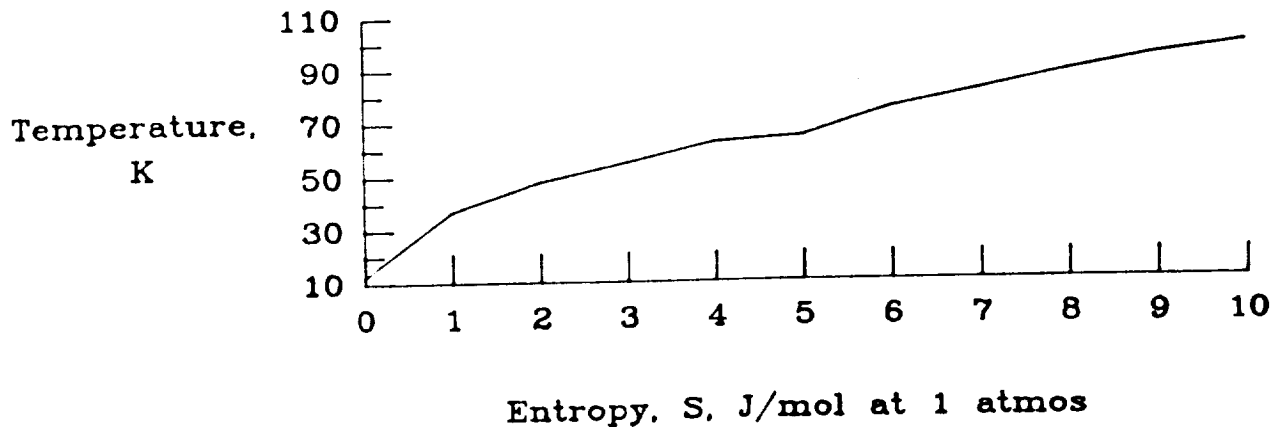
The LEZ chart options allow users to enhance the charts by including additional notation, modifying color schemes, changing the position of the charts on the page, and combining charts onto a single page to generate composite charts. These options increase the flexibility of the LEZ generated chart, thus minimizing the need to use other graphics packages. Proper use of the LEZ routines as shown in this document will ensure clear and legible charts requiring little or no change in the development and execution of the user's plot program. For a list of available options, refer to LEZOPT in Appendix A.



a) Composition of Superalloy



b) Low pressure fatigue of Superalloy



c) Temperature vs. entropy for Superalloy

Figure num. Characteristic charts for Superalloy CGMDX1
Figure 3-1. The three basic LEZ chart types.

3.1.1 Overview of the Sequence of Calls of All LEZ Routines

The order of the calls to the LEZ routines necessary to generate a chart is similar for the three basic chart types. Since many of the LEZ routines are optional, the user only need call those routines which will refine the chart as desired. Both required and optional routines should follow the order as indicated in figure 3-2. If this order is not followed the chart may not be legible or may not appear as desired.

For any of the LEZ generated charts, the following calls are required. Any other routines will be described in the subsection dealing with that specific LEZ call.

LEZINI: Initialize the Common Graphics Library and the underlying graphics package. This routine sets the LEZ defaults and indicates on which device(s) the chart is to be drawn (metafile, screen, or both). The default page size is 7.0 X 7.0 inches.

LEZSHW: Draws the chart as it is currently defined by all previous LEZ calls. This routine may be called more than once between LEZINI and LEZTRM. This allows the user to view the chart as each new annotation and/or refinement is specified.

At this point the user can refine the chart by making more calls to the LEZ routines, or the user can terminate the graphics session by calling LEZTRM.

LEZTRM: Ensures the completion of all graphics output and terminates both the Common Graphics Library and the underlying graphics package. This must be the last LEZ routine called by the applications program.

LEZINI may be called again after this LEZTRM to start the creation of another chart. However, the use of LEZTRM will end and rewind the metafile. Therefore, if multiple frames (i.e., plots) are to be written to metafile, then LEZTRM should only be called once after the last chart is generated.

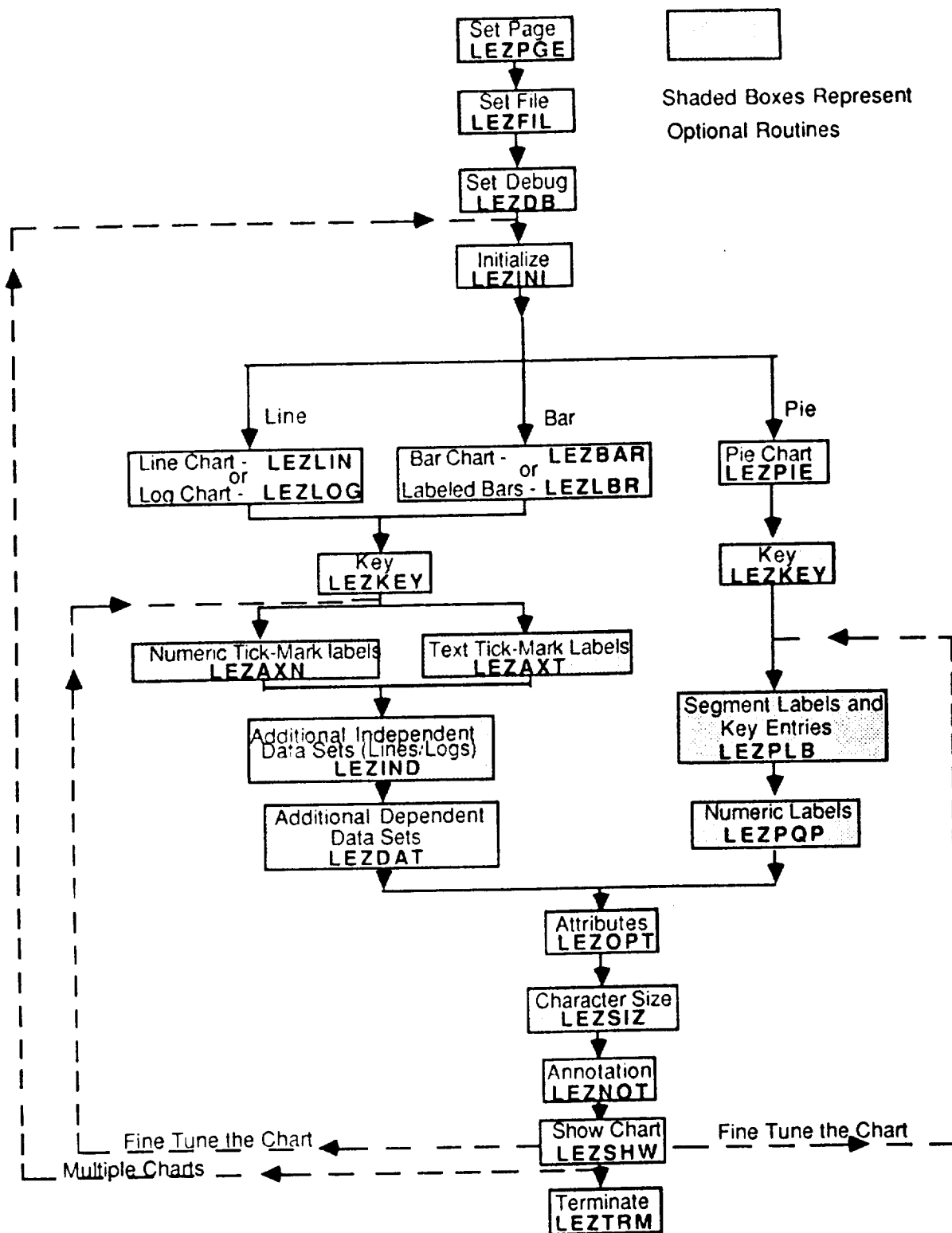


Figure 3-2. The sequence of LEZ calls to generate a chart.

3.2 Line Charts

All line charts generated by the LEZ routines follow the previously described sequence of subroutine calls as shown in figure 3-2. The available line chart routines are LEZLIN and LEZLOG. The LEZLIN routine is used for generating linear charts. For a linear scale, the change in values between tick marks is constant. A line chart showing time versus temperature would be an example of a linear chart that could be generated using LEZLIN. The LEZLOG routine is used for data sets that require a logarithmic scale for the independent, the dependent axis, or both axes. For a logarithmic scale, the change in value between tick marks varies logarithmically. Logarithmic scales are useful when the data to be plotted has a large range of values (e.g., between one and one billion).

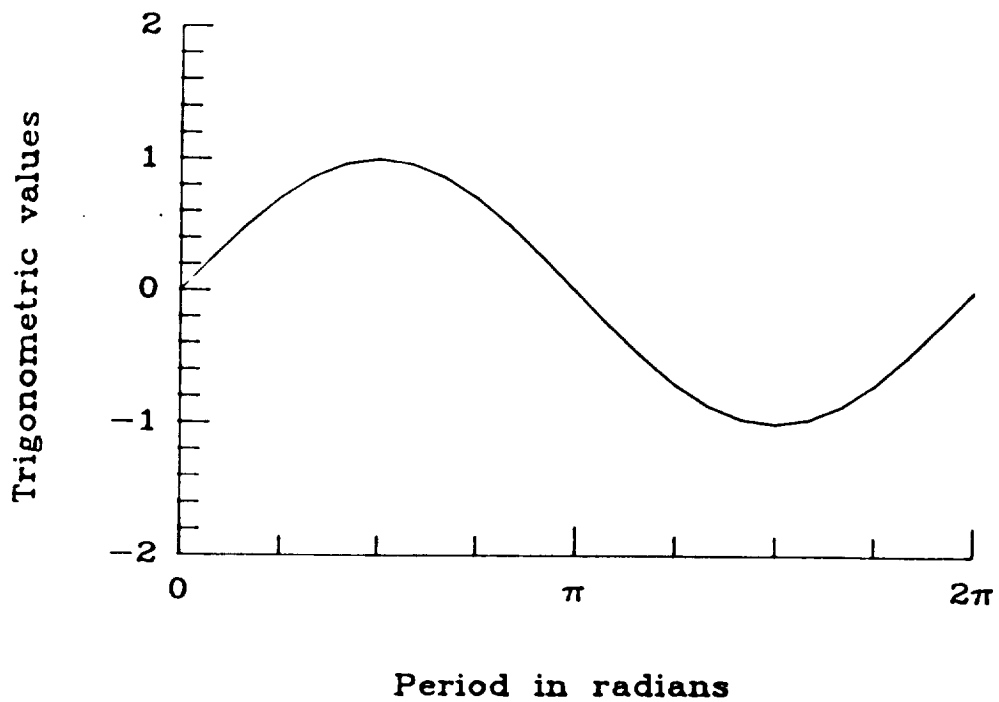
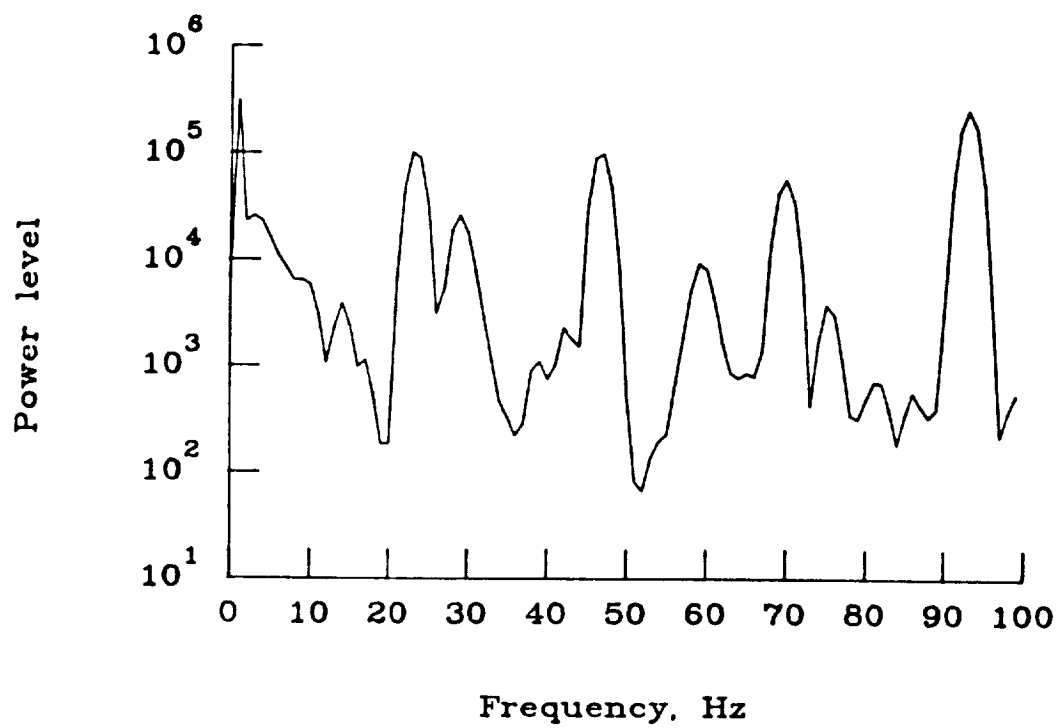


Figure 3-3. Linear and logarithmic charts.

CGMDX2

3.2.1 Steps Required to Generate Line Charts

Figure 3-4 shows a flow chart of the order in which the LEZ routines should be called to produce a line chart. The optional routines LEZPGE (which sets the page size), LEZFIL (which sets the error and debug destinations), and LEZDB (which sets the debug level) will be described in detail later in section 3.6.

The following subsections (i.e., 3.2.2 through 3.2.7) provide an overview of the necessary and optional routines available to generate a line chart. The following pages provide a worded outline of how to produce various types of the basic line chart. The routine names in bold are those which are of primary interest in that subsection. Unless otherwise stated, the line charts shown in this section were produced by using only the necessary LEZ routines. The user is referred to Appendix A for a complete description of the LEZ routines, and their associated arguments. These examples, along with additional ones, appear in Appendix B with a listing of the source code which produced them.

Although the LEZ line routines can be used to generate publication and/or viewgraph quality charts, please refer to section 1.6 for a list of considerations necessary to conform to those standards.

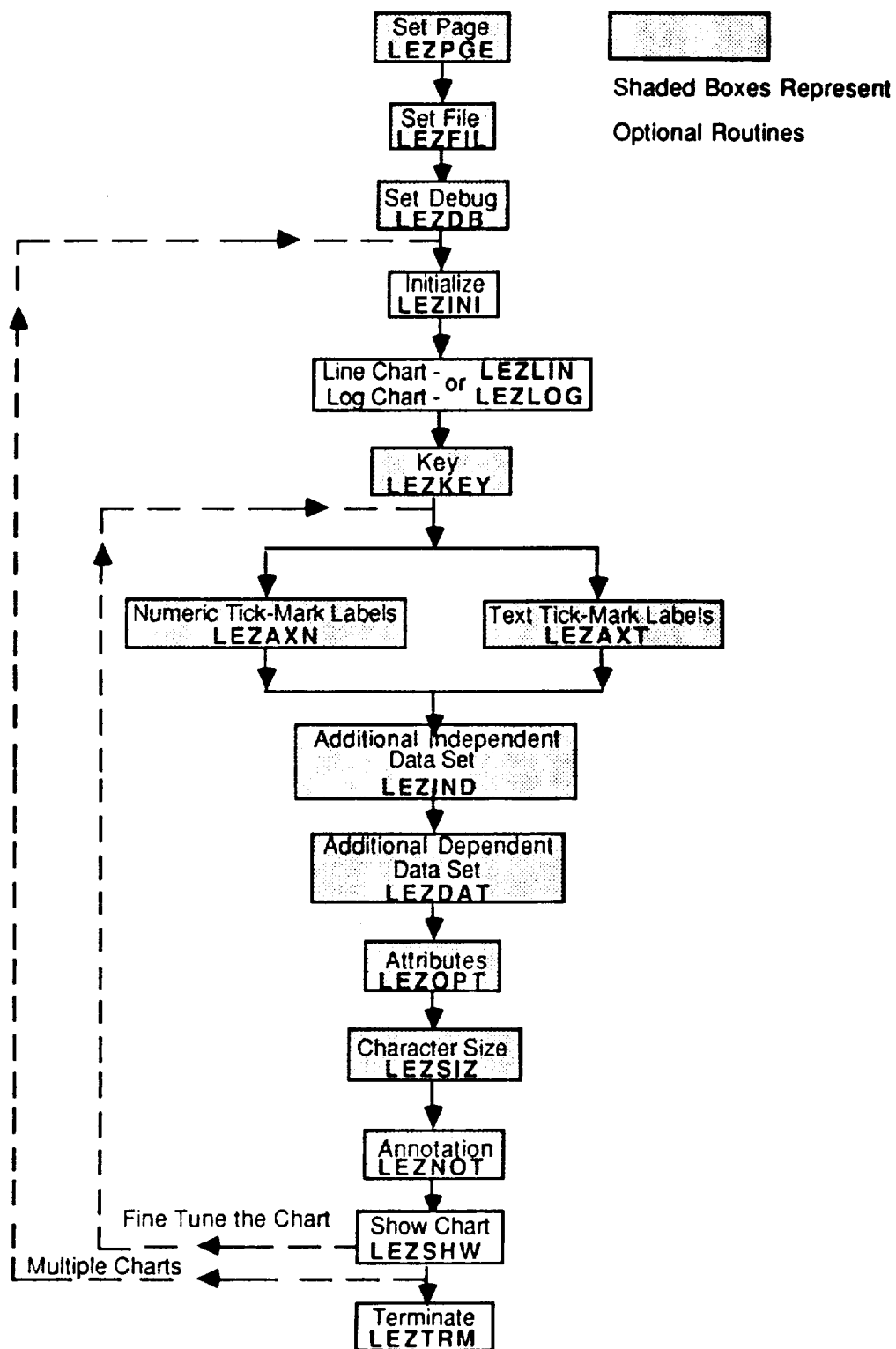


Figure 3-4. The sequence of LEZ calls to generate a line chart.

The following section provides a brief description of the LEZ routines pertaining to the linear and logarithmic charts. Although a more detailed description for each subroutine is given in Appendix A, the following descriptions are presented here to acquaint the user with the LEZ interface. The routines below are described in the order of use (see figure 3-4).

LEZLIN: Establishes the chart as a linear chart. Tick marks are positioned beginning at the input minimums and ending at the input maximums. By default there are eleven major tick marks per axis.

or

LEZLOG: Establishes the chart as a logarithmic chart. This routine expects logarithmic data (i.e., the log of the data is to be done prior to calling LEZLOG).

LEZKEY: Initiates the creation of a key for the chart. There can be only one key per chart. The location of the key is specified in this routine by an XY position about which the key will be justified. The key can be put anywhere on the page, keeping in mind that it will overwrite any plotting done at that position.

LEZAXN: Overrides the default numeric tick mark labels, and specifies numeric tick mark labels for an axis. This routine is used to change the appearance of the axis (i.e., numeric tick mark labels and/or the number of major and minor tick marks). This routine can be used for either/or both axes. This routine does not change the corresponding data coordinate system!

LEZAXT: Overrides the default numeric tick mark labels, and specifies user-supplied text tick mark labels for an axis. This routine can be used for either or both axes.

LEZIND: Defines an additional independent array of data.

LEZDAT: Adds an additional dependent data set to the chart. The relationship among dependent data sets is absolute. If a key is used for the chart, the key entry associated with this data set is supplied by this routine.

LEZOPT: Sets options to change the appearance of the current chart. Once the attributes have been changed, the new values are used for all the following charts until they are changed again either by calling LEZOPT again or calling LEZINI.

LEZSIZ: Changes the height, width, and gap of the text. This routine changes the size of the text used during the generation of the chart. This size remains in force until LEZSIZ is called again, or LEZINI is called (resetting the text characteristics back to the defaults).

LEZNOT: Defines and positions a note on the current chart. The note is displayed when LEZNOT is called, not in LEZSHW with the rest of the chart. The note may be placed anywhere on the page and may be rotated about an XY position about which the note will be justified.

LEZSIZ may be called prior to this routine to change the text height, width, and gap. When refining the chart, if the screen is cleared after LEZSHW is called the notes must be input again if they are to appear on the chart after the second call to LEZSHW.

Notes.

3.2.2 Linear Chart with Defaults

This section shows how to generate linear charts using the defaults (i.e., the minimal number of calls possible). By default, both axes will be drawn with 11 major tick marks. Thus, the tick mark labels may not conform to publication quality standards depending on the minimum and maximum values of the axis (i.e., INDMIN and INDMAX, DEPMIN and DEPMAX). Sections 3.2.3, 3.2.5, and 3.2.6 provide alternative methods for obtaining more suitable tick mark labels.

There are only four calls to the LEZ routines necessary to obtain a line chart using the defaults. The necessary calls are:

LEZINI

LEZLIN:

Establishes the chart as a linear chart. Tick marks are positioned beginning at the input minimums and ending at the input maximums. By default there are 11 major tick marks per axis.

LEZSHW

LEZTRM

The following program generates figure 3-5 by calling only the necessary LEZ routines. This program is shown here in an uncommented form to provide the user with an example of how to use the LEZ routines. A fully commented listing of this program is found in Appendix B.

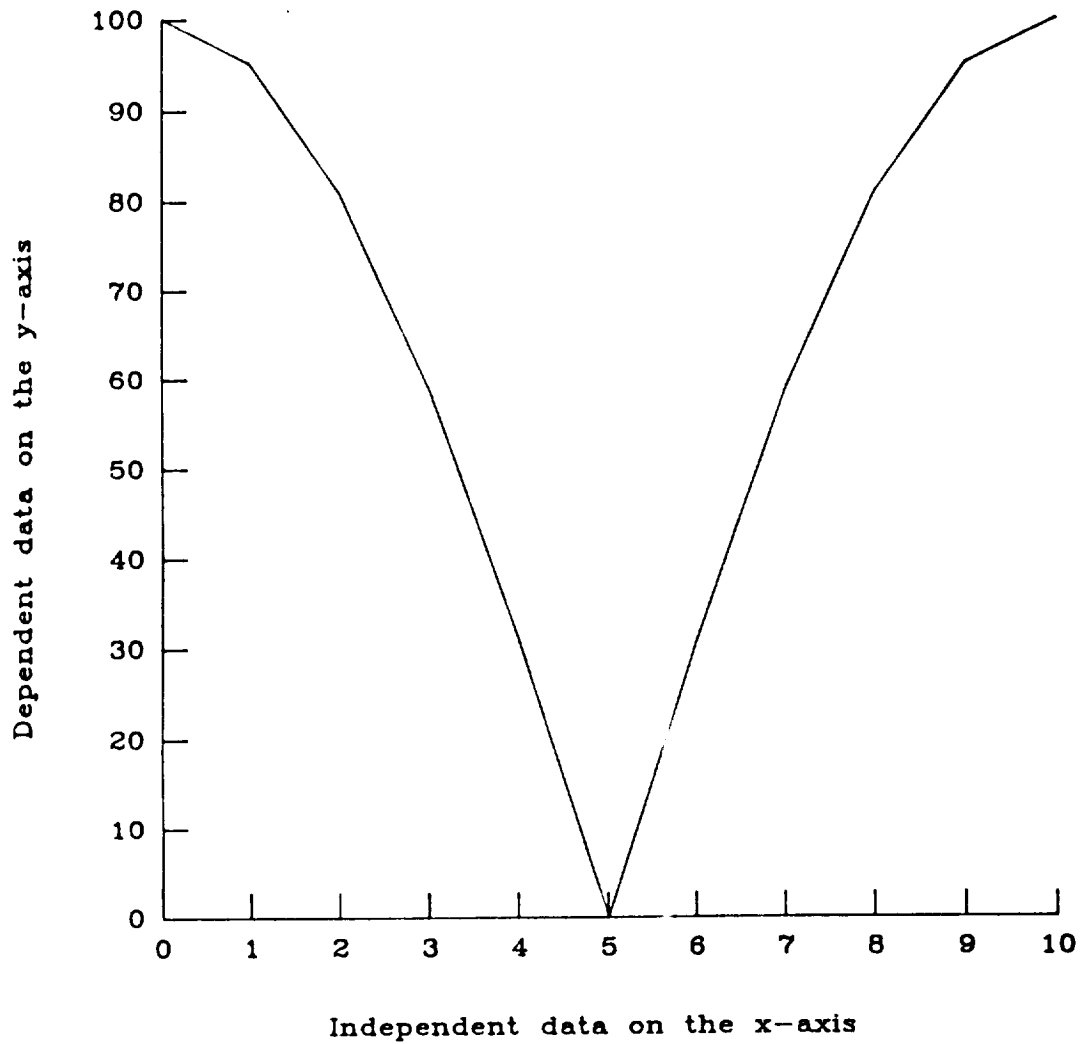
```
PROGRAM DCLINI
CHARACTER TITLE*80, IAXLBL*80, DAXLBL*80
REAL X(0:10), Y(0:10), INDMIN, INDMAX
DTRAD=ATAN(1.)/45.
DO 10 I=0,10
    X(I)=REAL(I)
10    Y(I)=ABS(100.*COS(X(I)*18.*DTRAD))
    IDEV=1
    CALL LEZINI(IDEV)
    NVALS=11
    TITLE=
+   'P[BLC]LOT OF Y=[FONT=24][ELC]B[FONT]100[BLC]COS18X'//
+   '[FONT=24][ELC]B'
    IAXLBL='I[BLC]NDEPENDENT DATA ON THE X-AXIS'
    DAXLBL='D[BLC]EPENDENT DATA ON THE Y-AXIS'
    INDMIN=X(0)
    INDMAX=X(10)
    DEPMIN=Y(5)
    DEPMAX=Y(10)
    INDHV=1
```



```

LINAPP=1
CALL LEZLIN(X,Y,NVALS,TITLE,IAXLFL,DAXLBL,INDMIN,
+INDMAX,DEPMIN,DEPMAX,INDHV,LINAPP)
CALL LEZNOT('DCLIN1',7.,0.,3,1,0)
CALL LEZSHW
CALL LEZTRM
STOP
END

```



Plot of $y = |100 \cos 18x|$

DCLIN1

Figure 3-5. Linear chart using defaults.

Notes.

3.2.3 Linear Chart with Automatic Scaling

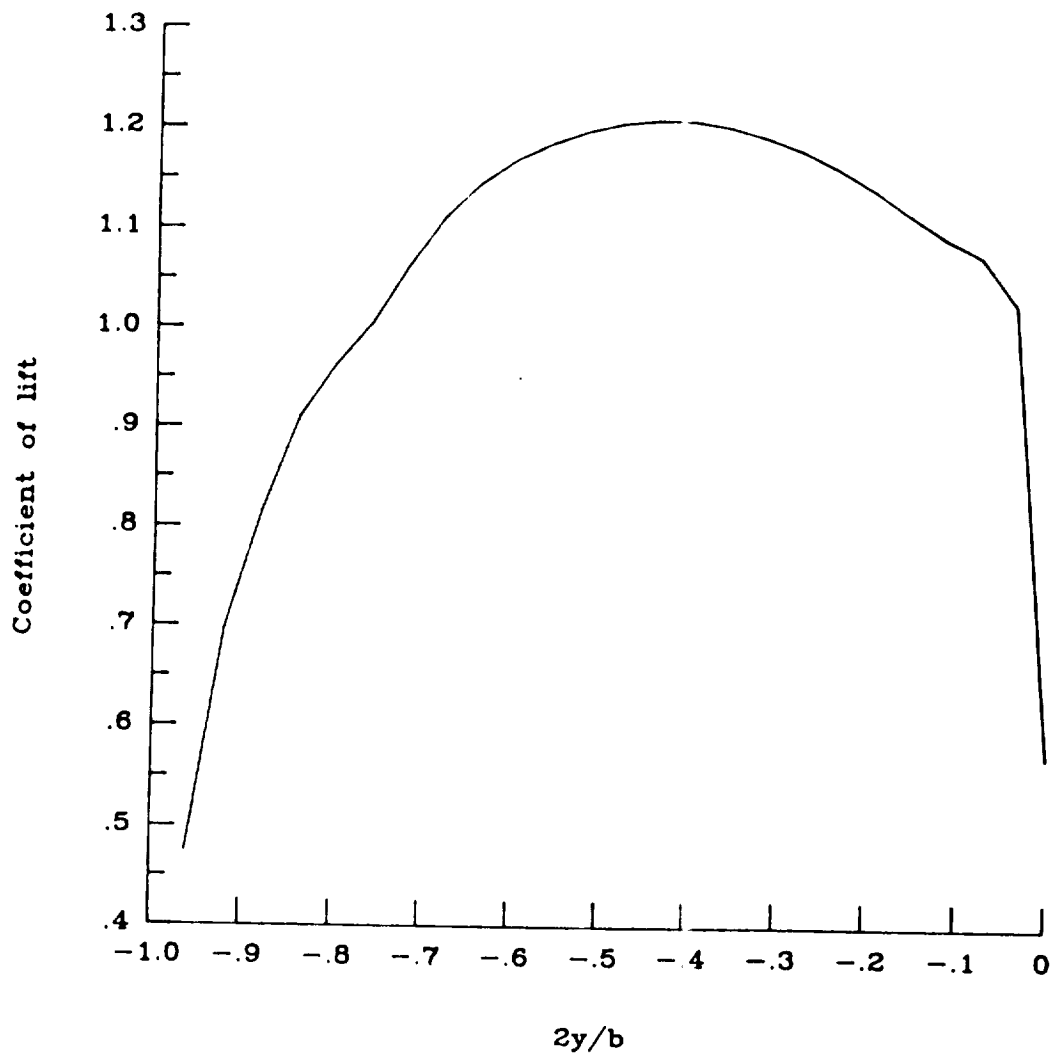
If the range of all data sets is not known *a priori* the use of the automatic scaling feature is recommended. The LEZLIN routine can be invoked to automatically scale an axis. This means the routine will determine the minimum and maximum value of the initial data set and all subsequent data sets entered through LEZDAT. Once the range is determined, the library will adjust the number of major tick marks and their labels to conform to publication standards. The number of adjusted tick marks will range between 3 and 11, while the tick mark labels will have suitable increments conforming with publication standards, and be represented by a sufficient number of digits. For example, to automatically scale the dependent axis in increasing order, DEPMIN and DEPMAX should be set to the same positive real number (and *vice versa*). To automatically scale the independent axis in a decreasing order, INDMIN and INDMAX should be set to the same negative real number (and *vice versa*).

The following program generates figure 3-6 by calling only the necessary LEZ routines. This program is shown here in an uncommented form to provide the user with an example of how to use the LEZ routines. A fully commented listing of this program is found in Appendix B.

```

PROGRAM DCLIN2
CHARACTER TITLE*256, IAXLBL*80, DAXLBL*80
REAL SPAN(25), CLIFT(25), INDMIN, INDMAX
DATA CLIFT/.4748, .6962, .8165, .9102, .9631, 1.005, 1.063, 1.112,
+1.146, 1.170, 1.187, 1.199, 1.207, 1.210, 1.209, 1.203, 1.193, 1.180,
+1.163, 1.142, 1.117, 1.094, 1.076, 1.028, .5721/
RI=-1.0
DO 1 I=1, 25
    RI=RI+.04
1    SPAN(I)=RI
IDEV=0
CALL LEZINI(IDEV)
NVALS=25
TITLE='V[BLC]ORTEX FLOW ABOUT A 60[BSUP]O[ESUP] DELTA WING WITH [F
+ONT=9]A[FONT]=20[BSUP]O'
IAXLBL='2[BLC]Y/B'
DAXLBL='C[BLC]OEFFICIENT OF LIFT'
INDMIN=0.
INDMAX=0.
DEPMIN=0.
DEPMAX=0.
INDHV=1
LINAPP=1
CALL LEZLIN(SPAN, CLIFT, NVALS, TITLE, IAXLBL, DAXLBL, INDMIN, INDMAX,
+DEPMIN, DEPMAX, INDHV, LINAPP)
CALL LEZNOT('DCLIN2', 7., 0., 3, 1, 0)
CALL LEZSHW
CALL LEZTRM
STOP
END

```



Vortex flow about a 60° delta wing with $\alpha=20^\circ$

DCLIN2

Figure 3-6. Linear chart with automatic scaling.

Notes.

3.2.4 Linear Chart with a Decreasing Numeric Axis

The user may desire to plot data with an axis which has decreasing tick mark values. The user can invoke the LEZLIN routine to plot with decreasing axes, by passing the minimum greater than the maximum for the appropriate axis (dependent or independent). For example, to obtain a decreasing dependent axis with tick mark values from 10.0 to -10.0, pass DEPMIN as 10.0 and DEPMAX as -10.0. Similarly, to obtain a decreasing independent axis with tick mark values from 10.0 to -10.0, pass INDMIN as 10.0 and INDMAX as -10.0.

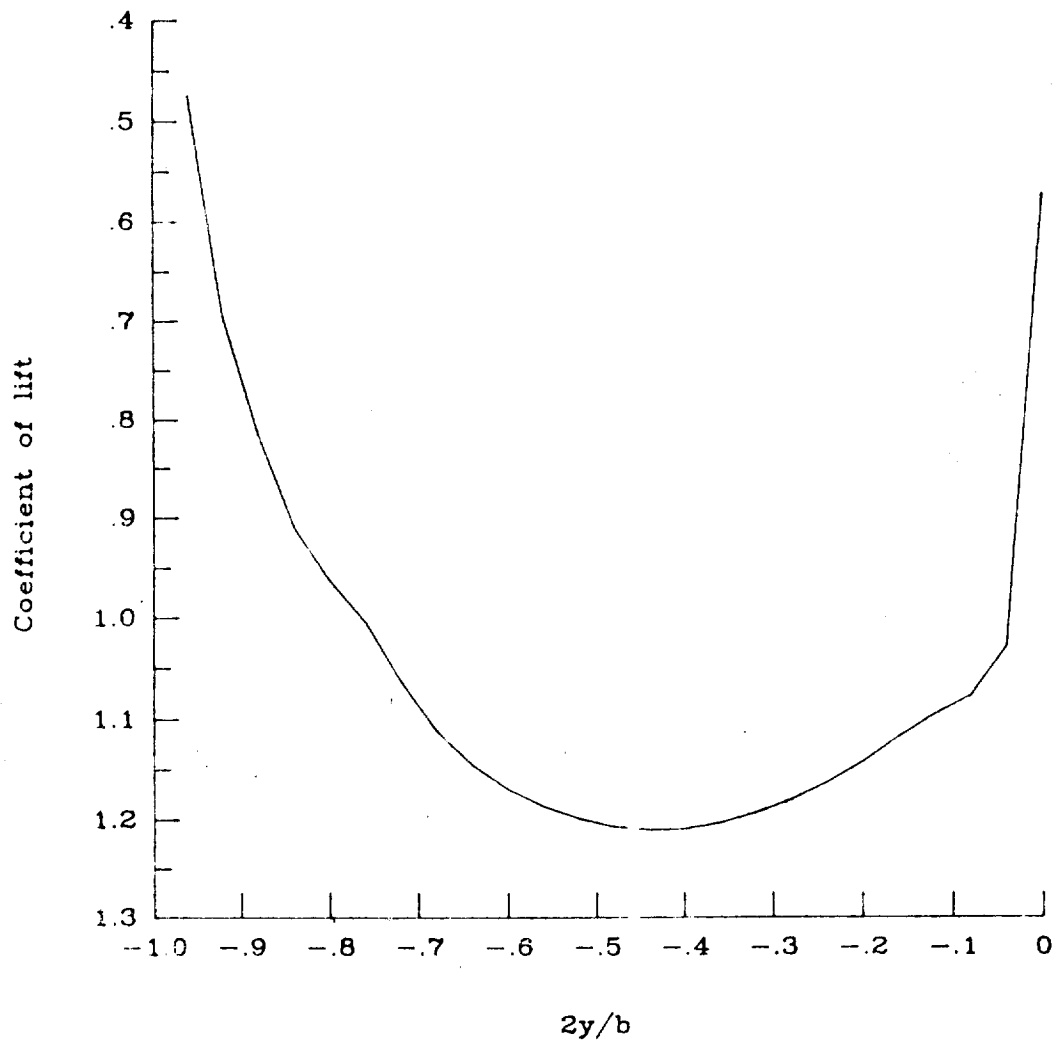
PRECEDING PAGE BLANK NOT FILMED

The following program generates figure 3-7 by calling only the necessary LEZ routines. This program is shown here in an uncommented form to provide the user with an example of how to use the LEZ routines. A fully commented listing of this program is found in Appendix B.

```

PROGRAM DCLIN3
CHARACTER TITLE*256,IAXLBL*80,DAXLBL*80
REAL SPAN(25),CLIFT(25),INDMIN,INDMAX
DATA CLIFT/.4748,.6962,.8165,.9102,.9631,1.005,1.063,1.112,
+1.146,1.170,1.187,1.199,1.207,1.210,1.209,1.203,1.193,1.180,
+1.163,1.142,1.117,1.094,1.076,1.028,.5721/
RI=-1.0
DO 1 I=1,25
    RI=RI+.04
1    SPAN(I)=RI
IDEV=0
CALL LEZINI(IDEV)
NVALS=25
TITLE='V[BLC]ORTEX FLOW ABOUT A 60[BSUP]O[ESUP] DELTA WING WITH [F
+ONT=9]A[Font]=20[BSUP]O'
IAXLBL='2[BLC]Y/B'
DAXLBL='C[BLC]OEFFICIENT OF LIFT'
INDMIN=-1.
INDMAX=0.
DEPMIN=-1.0
DEPMAX=-1.0
INDHV=1
LINAPP=1
CALL LEZLIN(SPAN,CLIFT,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+DEPMIN,DEPMAX,INDHV,LINAPP)
CALL LEZNOT('DCLIN3',7.,0.,3,1,0)
CALL LEZSHW
CALL LEZTRM
STOP
END

```

Vortex flow about a 60° delta wing with $\alpha=20^\circ$

DCLIN3

Figure 3-7. Linear chart with a decreasing numeric axis.

Notes.

3.2.5 Linear Chart with a Specified Numeric Axis

Although the defaults will produce a linear chart with tick marks, the number of tick marks and tick mark labels may not be suitable. The following section describes how to override an axis appearance. The data coordinate system, based on the data minimums and maximums, will not be changed. Thus, it is strongly recommended to keep the axis and the data coordinate system consistent. LEZAXN may not be used for an axis that has been autoscaled until after LEZSHW has been called.

There are only five LEZ routines necessary to obtain a line chart with specified numeric axes. The calls necessary are:

LEZINI

LEZLIN

LEZAXN: Overrides the default numeric tick mark labels, and specifies user supplied numeric tick mark labels for an axis. This routine is used to change the **appearance of the axis** (i.e., numeric tick mark labels and/or the number of major and minor tick marks). This routine can be used for either/or both axes. **This routine does not change the corresponding data coordinate system!** The data coordinate system is determined in LEZLIN, based on the minimum and maximum values of the independent and dependent data sets. If a different data coordinate system is desired, the current chart should be terminated (LEZTRM) and a new chart generated with the appropriate data coordinate system.

LEZSHW

LEZTRM

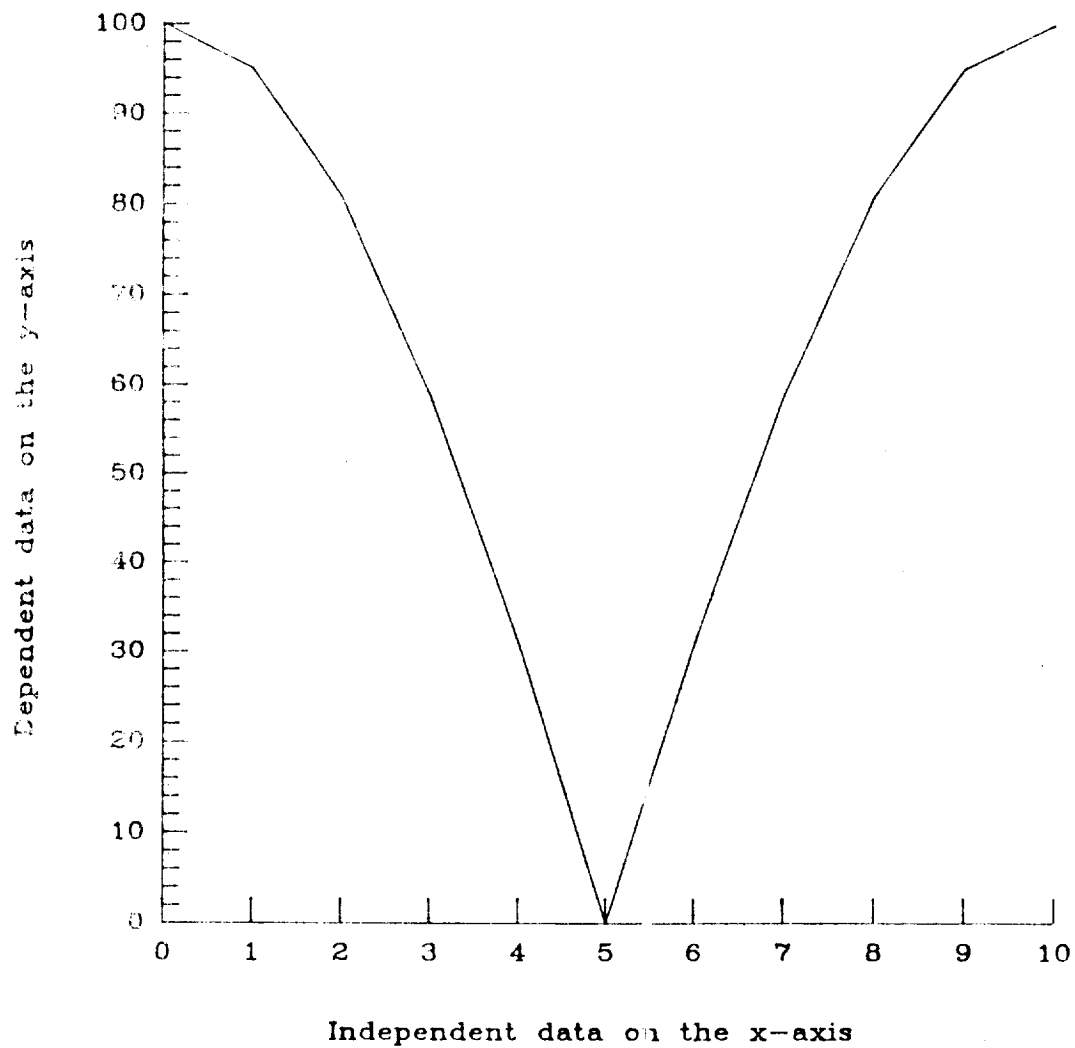
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The following program generates figure 3-8 by calling only the necessary LEZ routines. This program is shown here in an uncommented form to provide the user with an example of how to use the LEZ routines. A fully commented listing of this program is found in Appendix B.

```

      PROGRAM DCLIN4
      CHARACTER TITLE*80, IAXLBL*80, DAXLBL*80
      REAL X(0:10), Y(0:10), INDMIN, INDMAX
      DTRAD=ATAN(1.)/45.
      DO 10 I=0,10
        X(I)=REAL(I)
10    Y(I)=ABS(100.*COS(X(I)*18.*DTRAD))
      IDEV=1
      CALL LEZINI(IDEV)
      NVALS=11
      TITLE=
+ 'P[BLC]LOT OF Y=[FONT=24][ELC]B[FONT]100[BLC]COS18X'//
+ '[FONT=24][ELC]B'
      IAXLBL='I[BLC]NDEPENDENT DATA ON THE X-AXIS'
      DAXLBL='D[BLC]EPENDENT DATA ON THE Y-AXIS'
      INDMIN=X(0)
      INDMAX=X(10)
      DEPMIN=Y(5)
      DEPMAX=Y(10)
      INDHV=1
      LINAPP=1
      CALL LEZLIN(X,Y,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,
+INDMAX,DEPMIN,DEPMAX,INDHV,LINAPP)
      IHV=2
      NDEC=-3
      TSTART=Y(5)
      TINCR=10.0
      TEND=Y(10)
      NTMINR=4
      CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)
      CALL LEZNOT('DCLIN4',7.,0.,3,1,0)
      CALL LEZSHW
      CALL LEZTRM
      STOP
      END

```



Plot of $y = |100\cos 18x|$

DCLIN4

Figure 3-8. Linear chart with a specified numeric axis.

Notes.

3.2.6 Linear Chart with a Character Axis

It is often desirable to override the default numeric axis labels with character axis labels. The labels could represent text values (e.g., the months of year) or numeric values in the form of character representation (e.g., *pi*, a format not provided by the LEZ routines).

There are only five LEZ routines necessary to obtain a line chart with a character axis. The calls necessary are:

LEZINI

LEZLIN

LEZAXT: Overrides the default numeric mark labels, and specifies user-supplied text mark labels for an axis. This routine can be used for either or both axes. This routine **only** changes the **axis appearance**, it does not change the corresponding **data coordinate system**!

LEZSHW

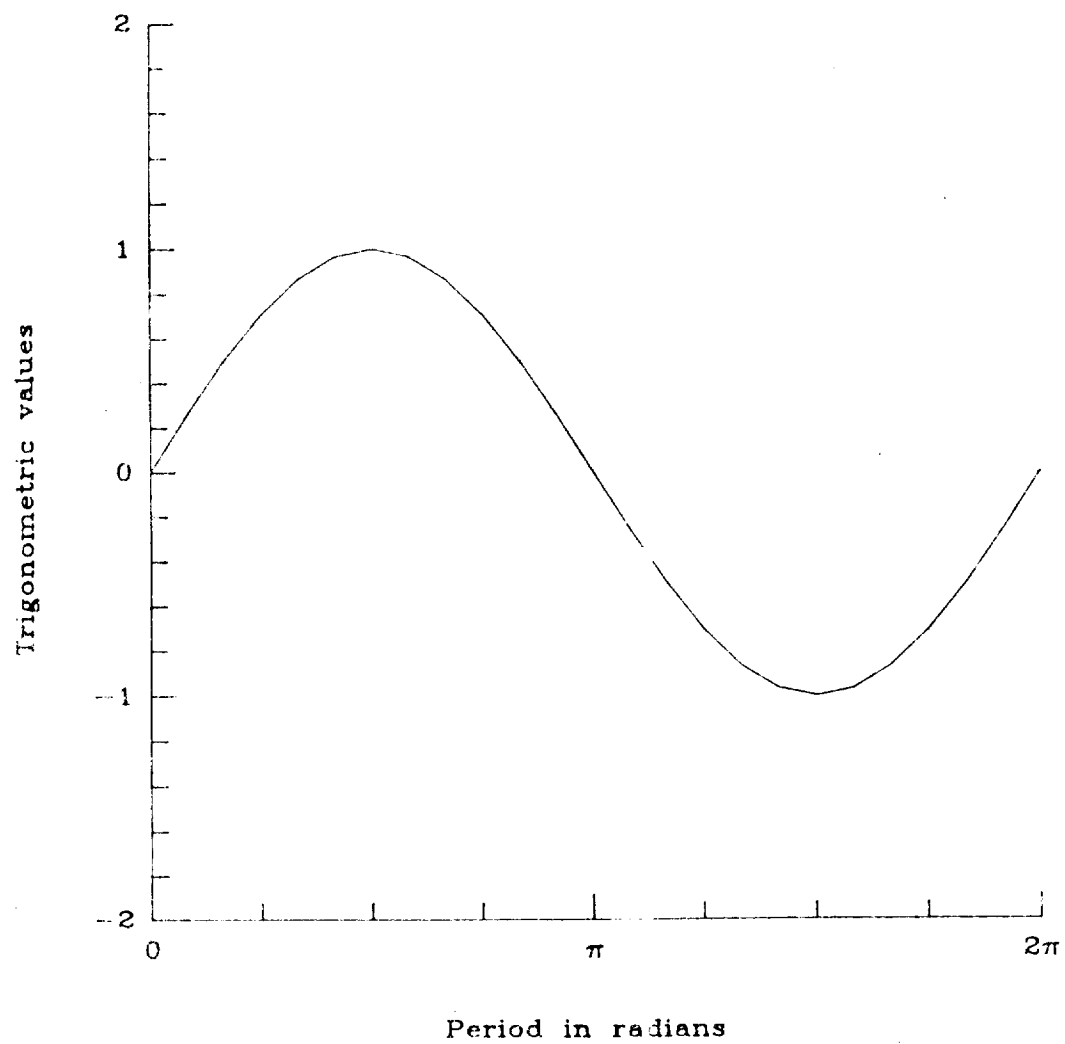
LEZTRM

The following program generates figure 3-9 by calling only the necessary LEZ routines. This program is shown here in an uncommented form to provide the user with an example of how to use the LEZ routines. A fully commented listing of this program is found in Appendix B.

```

PROGRAM DCLIN5
CHARACTER TITLE*80, IAXLBL*80, DAXLBL*80, LABELS*80
REAL PI(25), SSIN(25), INDMIN, INDMAX
WPI=ACOS(-1.)
DO 10 I=1,25
  RI=I
  PI(I)=(RI-1.)*(WPI/12.)
  SSIN(I)=SIN(PI(I))
10 CONTINUE
  IDEV=1
  CALL LEZINI(IDEV)
  NVALS=25
  TITLE='S[BLC]INE PLOT'
  IAXLBL='P[BLC]ERIOD IN RADIANS'
  DAXLBL='T[BLC]RIGONOMETRIC VALUES'
  INDMIN=PI(1)
  INDMAX=PI(25)
  DEPMIN=-2.0
  DEPMAX=2.0
  INDHV=1
  LINAPP=1
  CALL LEZLIN(PI, SSIN, NVALS, TITLE, IAXLBL, DAXLBL, INDMIN,
+INDMAX, DEPMIN, DEPMAX, INDHV, LINAPP)
  IHV=1
  NLABS=3
  LABELS='$O$(FONT=9)[BLC]Q$2(FONT=9)[BLC]Q$'
  NTMAJR=3
  NTMINR=3
  CALL LEZAXT(IHV, NLABS, LABELS, NTMAJR, NTMINR)
  IHV=2
  NDEC=-1
  TSTART=-2.0
  TINCR=1.0
  TEND=2.0
  NTMINR=4
  CALL LEZAXN(IHV, NDEC, TSTART, TINCR, TEND, NTMINR)
  CALL LEZNOT('DCLIN5', 7., 0., 3, 1, 0)
  CALL LEZSHW
  CALL LEZTRM
  STOP
END

```

Sine plot

DCLIN5

Figure 3-9. Linear chart with a character axis.

Notes.

3.2.7 Linear Chart with a Key

When more than one data set is displayed in the same chart, a key is often used to distinguish the data sets. This section describes how to generate a linear chart with a key.

There are only five LEZ routines necessary to obtain a line chart with a key. The calls necessary are:

LEZINI

LEZLIN

LEZKEY: Initiates the creation of a key for the chart. There can be only one key per chart. The location of the key is specified in this routine by an XY position about which the key will be justified. The key can be put anywhere on the page, keeping in mind that it will overwrite any plotting done at that position.

LEZDAT: Adds an additional dependent data set to the chart. The relationship among dependent data sets is **absolute**. If a key is used for the chart, the key entry associated with this data set is supplied by this routine. Note, this routine is optional.

LEZSHW

LEZTRM

The following program generates figure 3-10 by calling only the necessary LEZ routines. This program is shown here in an uncommented form to provide the user with an example of how to use the LEZ routines. A fully commented listing of this program is found in Appendix B.

```

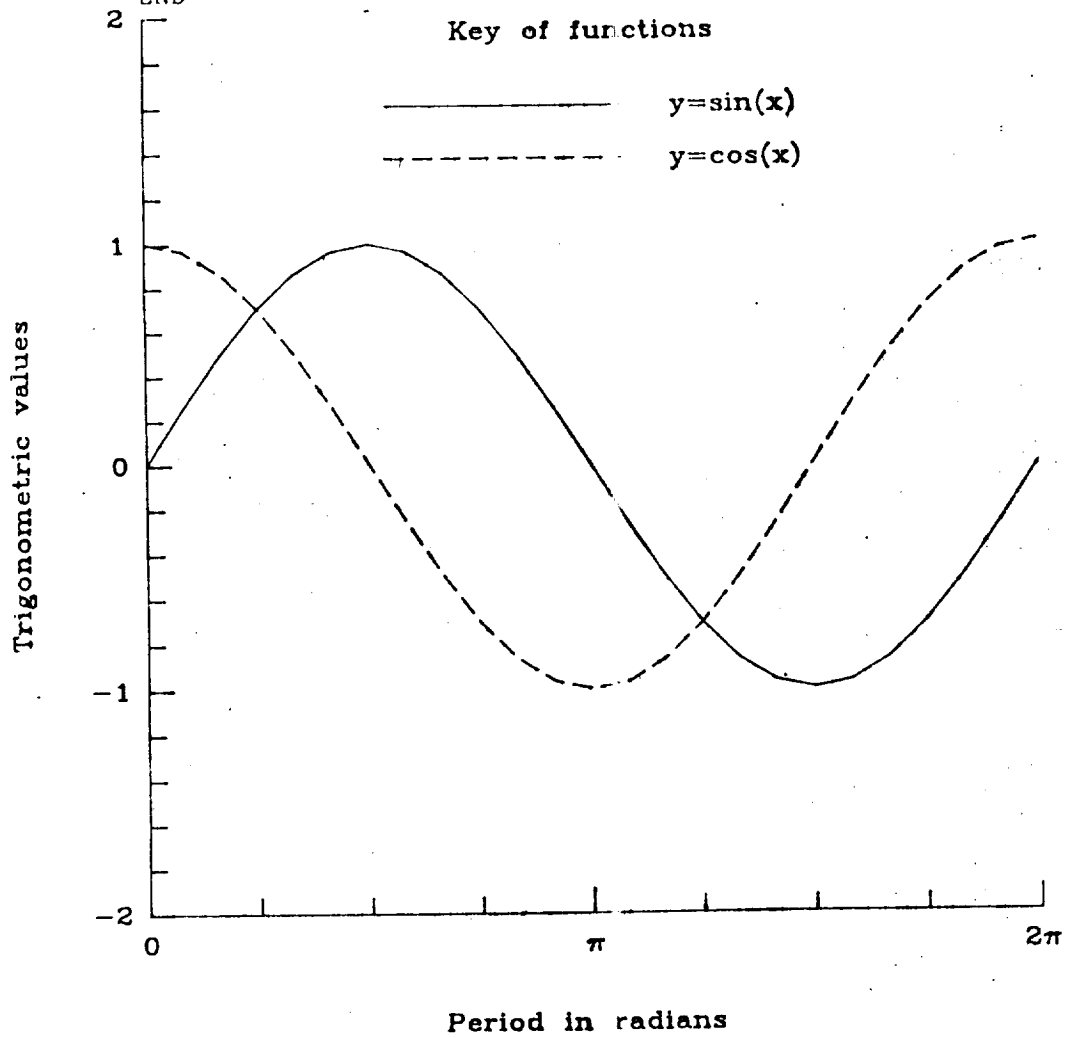
PROGRAM DCLIN6
CHARACTER TITLE*80, IAXLBL*80, DAXLBL*80, LABELS*80, KENTRY*80
REAL PI(25), SSIN(25), INDMIN, INDMAX, CCOS(25)
WPI=ACOS(-1.)
DO 10 I=1,25
RI=I
PI(I)=(RI-1.)*(WPI/12.)
SSIN(I)=SIN(PI(I))
CCOS(I)=COS(PI(I))
10 CONTINUE
IDEV=1
CALL LEZINI(IDEV)
NVALS=25
TITLE='P[BLC]LOT OF TRIGONOMETRIC FUNCTIONS'
IAXLBL='P[BLC]ERIOD IN RADIANS'
DAXLBL='T[BLC]RIGONOMETRIC VALUES'
INDMIN=PI(1)
INDMAX=PI(25)
DEPMIN=-2.0
DEPMAX=2.0
INDHV=1
LINAPP=1
CALL LEZLIN(PI, SSIN, NVALS, TITLE, IAXLBL, DAXLBL, INDMIN,
+INDMAX, DEPMIN, DEPMAX, INDHV, LINAPP)
TITLE='K[BLC]EY OF FUNCTIONS'
XPOS=5.25
YPOS=6.4
KENTRY='[BLC]Y=SIN(X)'
CALL LEZKEY(TITLE, XPOS, YPOS, KENTRY)
NVALS=25
IDTREL=1
IDTAPP=1
KENTRY='[BLC]Y=COS(X)'
CALL LEZDAT(CCOS, NVALS, IDTREL, IDTAPP, KENTRY)
IHV=1
NLABS=3
LABELS='$O${FONT=9}[BLC]Q$2[FONT=9][BLC]Q$'
NTMAJR=3
NTMINR=3
CALL LEZAXT(IHV, NLABS, LABELS, NTMAJR, NTMINR)

```

```

IHV=2
NDEC=-1
TSTART=-2.0
TINCR=1.0
TEND=2.0
NTMINR=4
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)
CALL LEZNOT('DCLIN6',7.,0.,3,1,0)
CALL LEZSHW
CALL LEZTRM
STOP
END

```



Plot of trigonometric functions

Figure 3-10. Linear chart with a key.

DCLIN6

Notes.

3.2.8 Logarithmic Charts

This section describes how to generate logarithmic charts. There are only four LEZ routines necessary to obtain a logarithmic chart. The calls necessary are:

LEZINI

LEZLOG: Establishes the chart as a logarithmic chart. This routine expects logarithmic data (i.e. the log of the data is to be performed prior to calling LEZLOG).

LEZSHW

LEZTRM

LEZLOG can generate two kinds of logarithmic charts. The first type is a 'log-log' chart which has a logarithmic independent axis and a logarithmic dependent axis. The second type is a 'semi-log' chart. A semi-log chart has one linear axis and one logarithmic axis. The variable IAXTYP of LEZLOG, determines which kind of logarithmic chart will be produced. Figure 3-11 shows a semi-log chart generated using only the four necessary calls. Logarithmic charts can be modified using LEZDAT, and LEZKEY the same way linear charts can be modified.

LEZLOG does not take the log (base 10) of the incoming data.

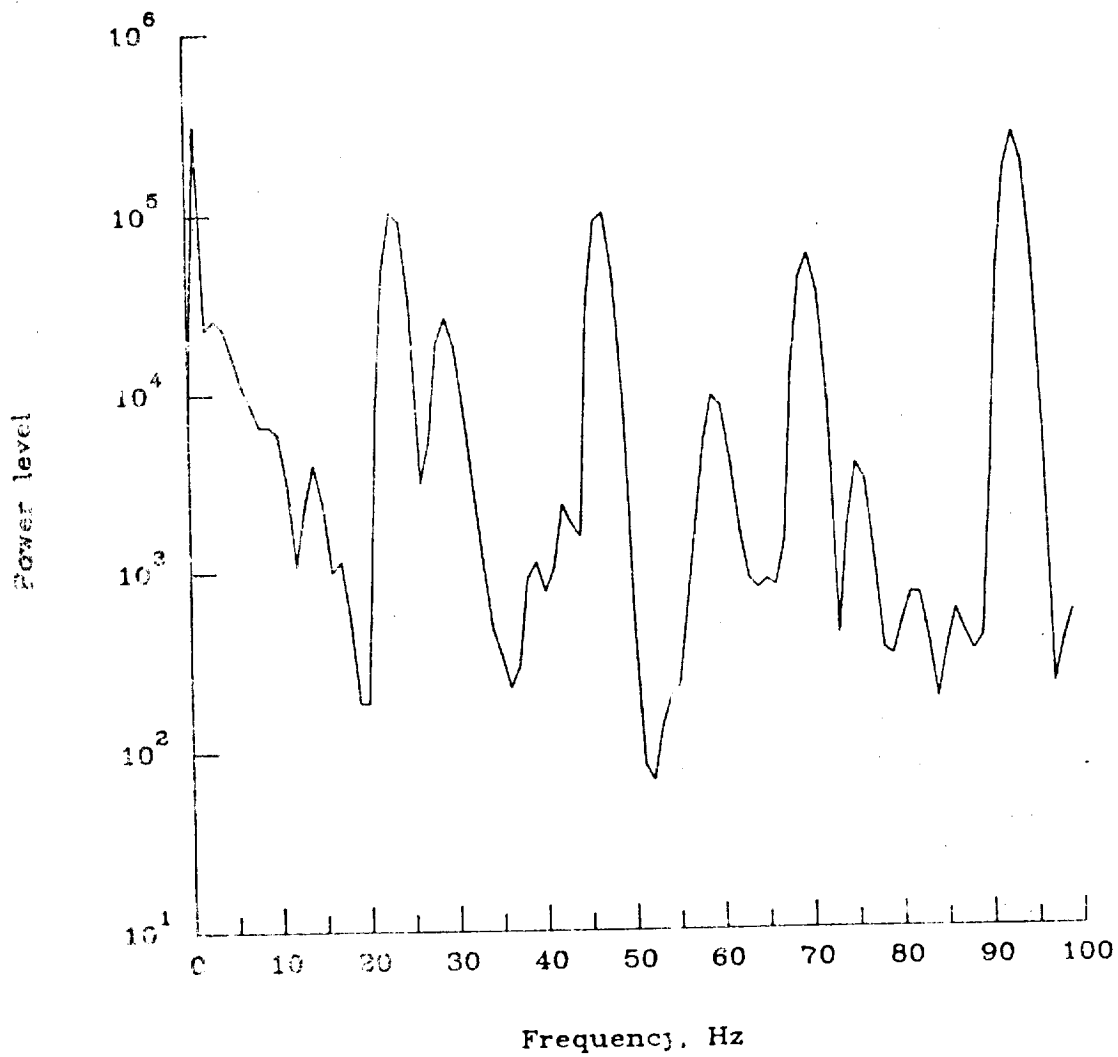
The following program generates figure 3-11, by calling only the necessary LEZ routines. This program is shown here in an uncommented form to provide the user with an example of how to use the LEZ routines. A fully commented listing of this program is found in Appendix B.

```
PROGRAM DCLOG1
CHARACTER TITLE*80, IAXLBL*80, OAXLBL*80, IOPT*8
LOGICAL LVALUE
REAL FREQ(100), POWER(100), IND4IN, INDMAX
DATA (POWER(I), I=1, 76)/
+ 7066.0770323, 313987.5856597, 23005.34014683, 25971.13637497,
+ 23314.47811626, 16222.72126054, 11123.46224798, 8573.673551723,
+ 6533.280733426, 6567.484820724, 5931.92717933, 3100.185764845,
+ 1075.542233512, 2304.552081512, 3938.878376374, 2372.668800947,
+ 990.5827153465, 1139.692923046, 539.1035104119, 186.2399260743,
+ 185.9121866205, 6922.275564152, 47871.80671708, 101610.8109471,
+ 90151.05656181, 32565.81919631, 3126.25985372, 5378.883275207,
+ 19139.27829711, 26311.51279586, 18051.10302768, 7595.925085295,
+ 2769.064915013, 1114.906853713, 472.3435990609, 336.5553643497,
+ 224.6112529072, 292.8078714839, 913.1650006148, 1111.290988571,
+ 763.2538952391, 1036.757022708, 2318.840862193, 1815.115702427,
+ 1546.468077257, 30998.79018191, 90446.39960755, 99542.65318885,
```

```

+ 46517.56984878, 8264.407149583, 477.4873134733, 82.183079214,
+ 67.7501808438, 136.6466583528, 197.6147132091, 229.3505457034,
+ 643.2165902202, 1824.921600301, 5246.018888617, 9355.942325835,
+ 8240.202957789, 4042.516486596, 1615.454279283, 876.7523693048,
+ 780.321551955, 869.2380712535, 806.9102907816, 1417.485863451,
+ 13314.08558278, 42705.82833591, 56933.22987158, 34522.64829539,
+ 8369.70034301, 423.4410260173, 1721.308093883, 3815.021552281/
DATA (POWER(I),I=77,100)/
+ 3096.896818539, 1130.33337685, 351.6629052997, 323.9146852672,
+ 496.8216394068, 716.3789266813, 707.1830537755, 395.452882063,
+ 185.9595078555, 349.7278623283, 579.1256929328, 427.7957796537,
+ 339.4866401359, 404.7726592585, 3303.494231505, 44732.3344563,
+ 168132.2764905, 259620.2781873, 179647.069922, 51634.19154093,
+ 4701.338454798, 220.74733211, 377.2257021375, 552.6383507909/
DO 1 I=1,100
RI=I
FREQ(I)=RI-1.
POWER(I)=LOG10(POWER(I))
IDEV=1
CALL LEZINI(IDEV)
NVALS=100
TITLE='P[BLC]OWER LEVEL VS. FREQUENCY'
IAXLBL='F[BLC]REQUENCY, [ELC]H[BLC]Z'
DAXLBL='P[BLC]OWER LEVEL'
INDMIN=0.0
INDMAX=100.0
DEPMIN=LOG10(65.0)
DEPMAX=LOG10(290000.0)
IAXTYP=2
IHLOGI=0
IVLOGI=0
INDHV=1
LINAPP=1
CALL LEZLOG(FREQ,POWER,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+DEPMIN,DEPMAX,IAXTYP,IHLOGI,IVLOGI,INDHV,LINAPP)
IHV=1
I3=-3
NDEC=I3
TSTART=0.0
TINCR=10.0
TEND=100.0
NTMINR=1
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)
CALL LEZNOT('DCLOG1',7.,0.,3,1,0)
CALL LEZSHW
CALL LEZTRM
STOP
END

```

Power level vs. frequency

DCLOG1

Figure 3-11. Logarithmic chart.

3.2.9 Line Chart Options

The routine LEZOPT provides a variety of options which enable the user to override the default chart appearance. Table 3-1 lists these options in alphabetical order. Additionally, this table includes the corresponding initial defaults. Examples using many of these options are found in Appendix B.

<u>Option</u>	<u>Description</u>	<u>Type</u>	<u>Default value</u>
BFILLD	Whether to fill between lines	Array of INTEGERS 0 - do not fill 1 - fill	0 (do not fill)
CLEAR	To clear the screen or not	LOGICAL .TRUE. - to clear .FALSE. - not to clear	.TRUE. (to clear)
COLOR	Interior colors and line colors	Array of INTEGERS (see DI-3000 color table)	1 through 8 (cycled)
DASH	Dashed lines	LOGICAL .TRUE. - to dash .FALSE. - not to dash	.FALSE. (not to dash)
HAXLEN	Horizontal axis length	REAL	2/3 * page width
HTICPOS	Horizontal tick mark positioning	INTEGER 0 - tick marks suppressed 1 - above the axis 2 - below the axis 3 - above and below the axis	1 (above the axis)
HTLABR	Horizontal tick mark rotation	INTEGER	0 degrees
INTPAT	Interior patterns	Array of INTEGERS (see DI-3000 interior patterns)	15, 16, 18, 27, 28, 30, 39, 40 (cycled)
KEYJUST	Key justification	INTEGER 1 - lower left 2 - lower right 3 - upper left 4 - upper right	4 (Upper right)

Table 3-1. LEZOPT options for line and/or Logarithmic charts.

<u>Option</u>	<u>Description</u>	<u>Type</u>	<u>Default value</u>
LINPAT	Line patterns	Array of INTEGERS (see NASA standards)	1 through 8 (cycled)
PAUSE	To pause the screen or not	LOGICAL .TRUE. - to pause .FALSE. - not to pause	.TRUE. (to pause)
RTAXIS	To draw a <u>right</u> axis	LOGICAL .TRUE. - to draw axis .FALSE. - not to draw axis	.FALSE. (not to draw axis)
SYMNUM	Symbol number	Array of INTEGERS (see NASA standard)	1 through 8 (cycled)
SYMSIZ	Symbol size	Array of REALs	publication quality
VAXLEN	Vertical axis length	REAL	2/3 * page height
VLABDR	Vertical axis label direction	LOGICAL TRUE. - horizontal direction FALSE. - vertical direction	.FALSE. (vertical direction)
VTLABR	Vertical tick mark rotation	INTEGER	0 degrees
VTICPOS	Vertical tick mark positioning	INTEGER 0 - tick marks suppressed 1 - right of the axis 2 - left of the axis 3 - right and left of the axis	1 (right of the axis)
XORIGIN	X-origin of the data space	REAL	2/9 * page width
YORIGIN	Y-origin of the data space	REAL	2/9 * page height

Table 3.1. LEZOPT options for line and/or logarithmic charts (continued).

Notes.

3.3 Bars Charts

All bar charts generated by the LEZ routines follow the previously described sequence of subroutine calls as shown in figure 3-2. There are two bar routines available, LEZBAR and LEZLBR. The LEZBAR routine produces bar charts with two numeric axes. The independent data set is used to plot the bars where that data value appears on the axis. Thus, the bars are not necessarily evenly spaced along the independent axis. The LEZLBR routine generates a character independent axis. The user inputs the alphanumeric labels for each bar in the data set. The bars plotted with LEZLBR are evenly spaced along the independent axis. LEZAXN and LEZAXT can be used to modify all bar axis labels. However, altering the axis labels to differ from the corresponding data being represented is not recommended.

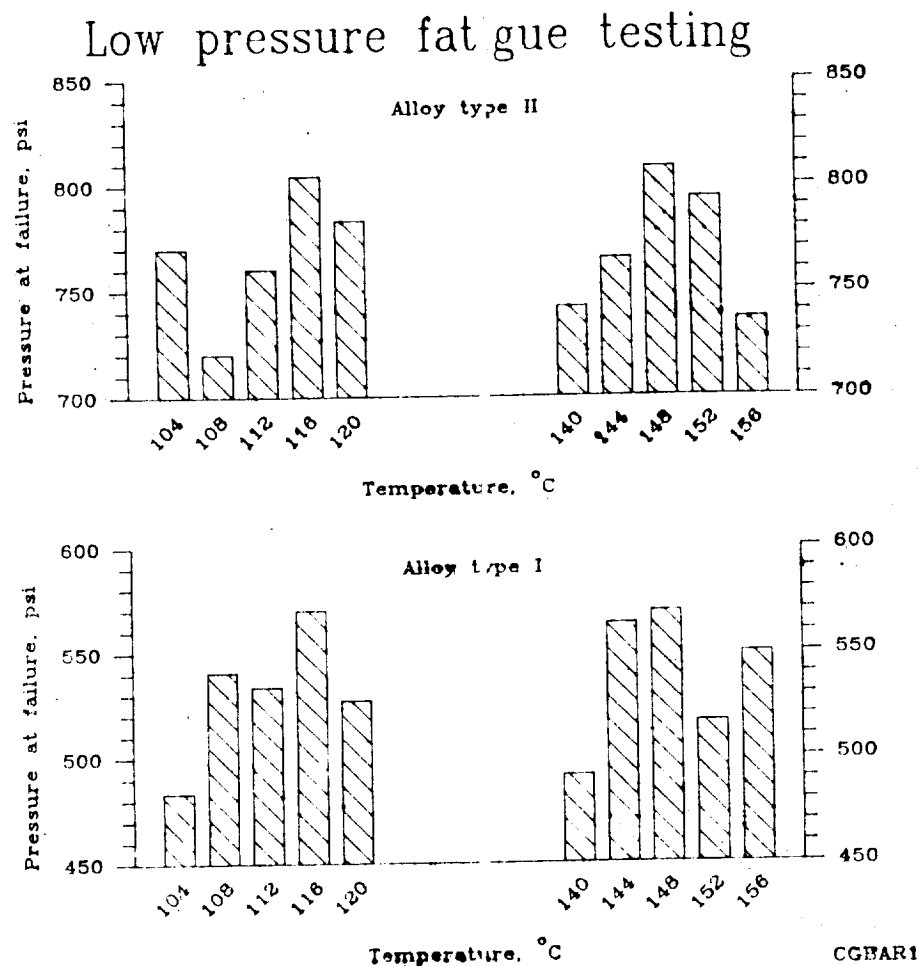


Figure 3-12. Bar chart examples.

3.3.1 Steps Required to Generate Bar Charts

Figure 3-13 shows a flow chart of the order in which the LEZ routines should be called to produce a bar chart. The optional routines LEZPGE which sets the page size, LEZFIL which sets the error and debug destinations, and LEZDB which sets the debug level will be described in detail later in Section 3.6.

The following subsections (i.e., 3.3.2 through 3.3.6) provide an overview of the necessary and optional routines available to generate bars. The following pages provide a worded outline of how to produce various types of the basic bar chart. The routine names in bold are those which are of primary interest in that subsection. Unless otherwise stated, the bar charts shown in this section were produced by using only the necessary LEZ routines. The user is referred to Appendix A for a complete description of the LEZ routines, and their associated arguments. These examples, along with additional ones, appear in Appendix B with a listing of the source code which produced them.

Although the LEZ line routines can be used to generate publication and/or viewgraph quality charts, please refer to section 1.6 for a list of considerations necessary to conform to those standards.

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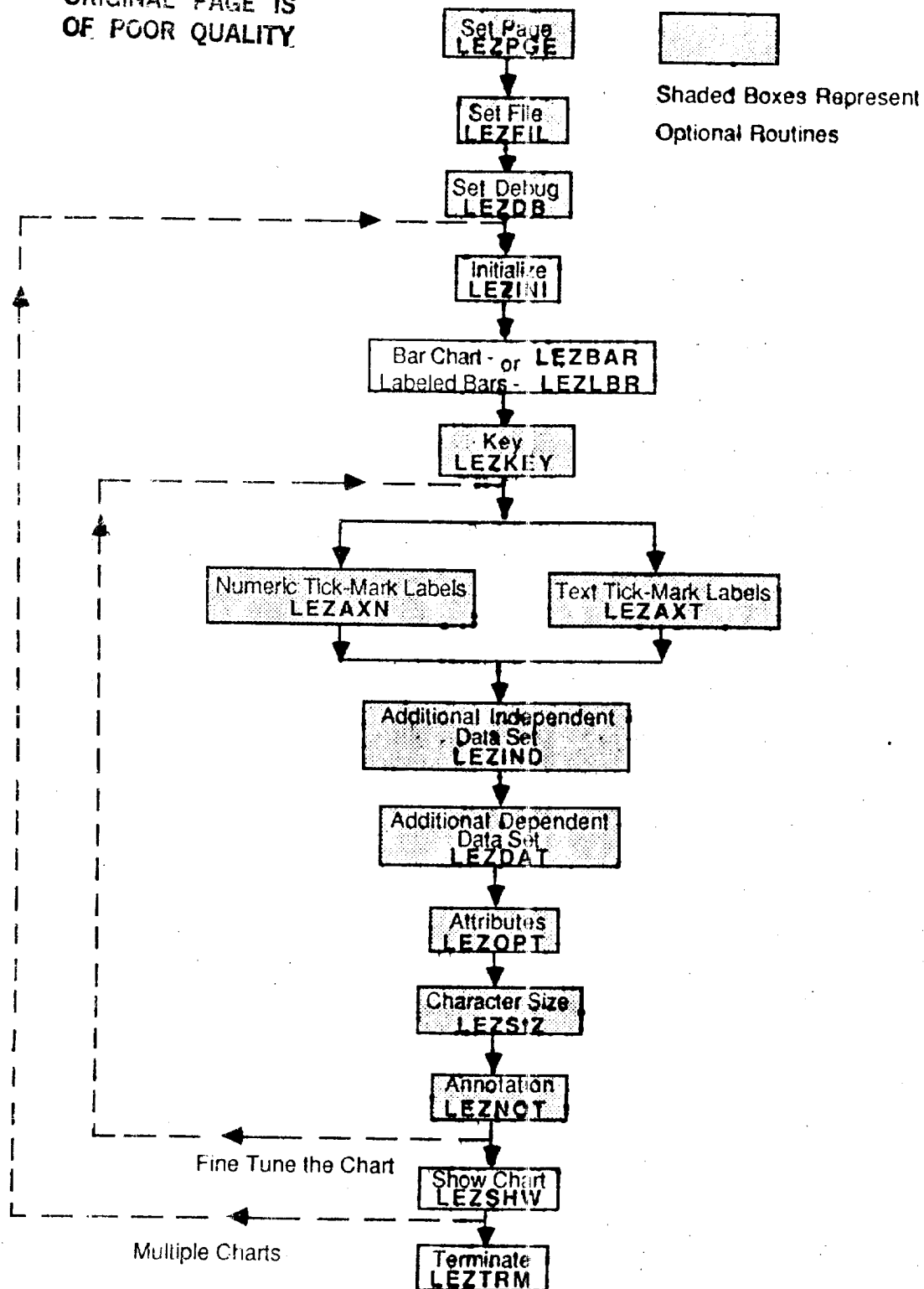


Figure 3-13. The sequence of LEZ calls to generate a bar chart.

The following section provides a brief description of the LEZ routines pertaining to the bar charts. Although a more detailed description for each is given in Appendix A, each routine is illustrated in the following subsections. The following descriptions are intended to acquaint the user with the LEZ interface. The routines below are described in the order of use (see figure 3-13).

LEZBAR: Establishes the chart as a bar chart such that the data and tick marks are placed at exact data locations on the axis. The bars are not necessarily evenly spaced. The tick marks are positioned beginning at the input minimums and ending at the input maximums. By default the tick marks are not drawn on the independent axis and are drawn to the left on the dependent axis. There are 11 major tick marks on the dependent axis.

or

LEZLBR: Establishes the chart as a bar chart with evenly spaced bars and text tick mark labels on the independent axis. For the dependent axis, the tick marks are positioned beginning at the input minimums and ending at the input maximums. By default, 11 major tick marks are drawn on the dependent axis, and not drawn on the independent axis.

LEZKEY: Initiates the creation of a key for the chart. There can be only one key per chart. The location of the key is specified in this routine by an XY position about which the key will be justified. The key can be put anywhere on the page, keeping in mind that it will overwrite any plotting done at that position.

LEZAXN: Overrides the default numeric tick mark labels, and specifies numeric tick mark labels for an axis. This routine is used to change the appearance of the axis (i.e., numeric tick mark labels and/or the number of major and minor tick marks). This routine can be used for either/or both axes. This routine does not change the corresponding data coordinate system!

LEZAXT: Overrides the default numeric tick mark labels, and specifies user-supplied text tick mark labels for an axis. This routine can be used for either or both axes.

LEZIND: Defines an additional independent array of data.

- LEZDAT:** Adds an additional dependent data set to the chart. The relationship among dependent data sets is absolute or additive. If a key is used for the chart, the key entry associated with this data set is supplied by this routine.
- LEZOPT:** Sets options to change the appearance of the current chart. Once the attributes have been changed, the new values are used for all the following charts until they are changed again either by calling LEZOPT again or calling LEZINI.
- LEZSIZ:** Changes the height, width, and gap of the text. This routine changes the size of the text used during the generation of the chart. This size remains in force until LEZSIZ is called again, or LEZINI is called (plotting the text characteristics back to the defaults).
- LEZNOT:** Defines and positions a note on the current chart. The note is displayed when LEZNOT is called, not in LEZSHW with the rest of the chart. The note may be placed anywhere on the page and may be rotated about an XY position about which the note will be justified.

LEZSIZ may be called prior to this routine to change the text height, width, and gap. When refining the chart, if the screen is cleared after LEZSHW is called the notes must be input again if they are to appear on the chart after the second call to LEZSHW.

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3.3.2 Bar Chart with Defaults

There are only four calls to LEZ routines necessary to obtain a bar chart using defaults. The calls necessary are:

LEZINI

LEZBAR: Establishes the chart as a bar chart such that the data and tick marks are placed at exact data locations on the axis. The bars are not necessarily evenly spaced. The tick marks are positioned beginning at the input minimums and ending at the input maximums. By default the tick marks are not drawn on the independent axis and are drawn to the left on the dependent axis. There are 11 major tick marks on the dependent axis.

LEZSHW

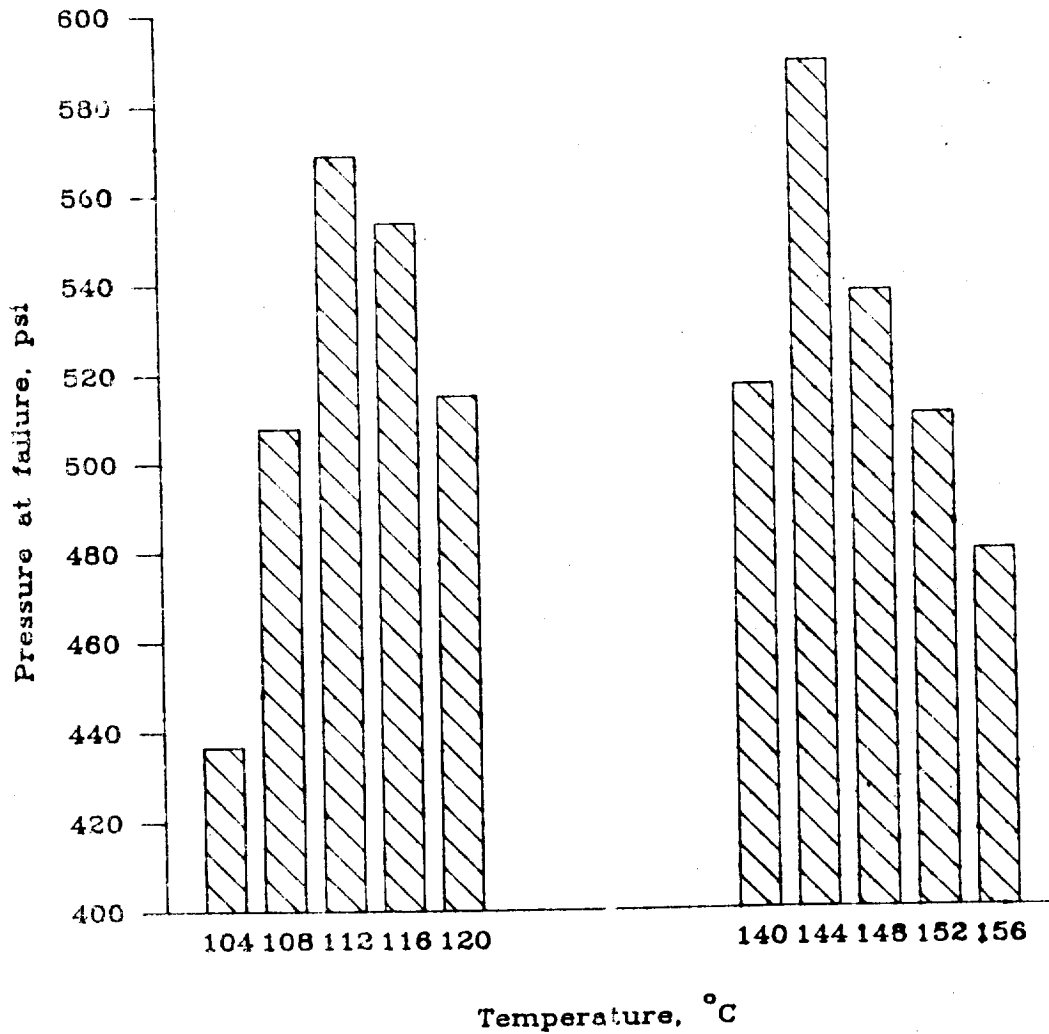
LEZTRM

The figure 3-14 shows a bar chart with numeric axes, only the necessary calls were used to generate this chart. Note that the bars appear at the position on the axis that the independent data values appear. Thus, LEZBAR will plot the data as the user provides. This may result with bars and/or the corresponding labels overlapping one another.

The following program generates figure 3-14 by calling only the necessary LEZ routines. This program is shown here in an uncommented form to provide the user with an example of how to use the LEZ routines. A fully commented listing of this program is found in Appendix B.

```
PROGRAM DCBAR1
REAL INDMAX,INDMIN,TEMP(10),PRESS(10)
CHARACTER IAXLBL*80,DAXLBL*80,TITLE*80
DATA TEMP /104.,108.,112.,116.,120.,140.,144.,148.,152.,156./
DATA PRESS /436.55,507.95,568.95,554.,515.3,517.25,589.35,537.95,
+          510.45,479.7/
IDEV = 1
CALL LEZINI (IDEV)
NVALS = 10
TITLE = 'L[BLC]OW PRESSURE FATIGUE TESTING'
IAXLBL = 'T[BLC]EMPERATURE, [BSUP]O[ESUP][ELC]C'
DAXLBL = 'P[BLC]RESSURE AT FAILURE, PSI'
INDMIN = 100.
INDMAX = 160.
DEPMIN = 400.
DEPMAX = 600.
INDHV = 1
IBRAPP = 1
```

```
CALL LEZBAR(TEMP,PRESS,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,  
+          DEPMIN,DEPMAX,INDHV,IBRAPP)  
CALL LEZNOT('DCBAR1',7.,0.,3,1,0)  
CALL LEZSHW  
CALL LEZTRM  
STOP  
END
```



Low pressure fatigue testing

DCBAR1

Figure 3-14. Bar chart using defaults.

3.3.3 Bar Chart with a Specified Numeric Axis

Generating a bar chart using defaults may not produce suitable tick mark labels.

There are only five calls to LEZ routines necessary in order to obtain a bar chart with a specified numeric axis. The calls necessary are:

LEZINI

LEZBAR

LEZAXN: Overrides the default numeric tick mark labels, and specifies numeric tick mark labels for an axis. This routine is used to change the appearance of the axis (i.e., numeric tick mark labels and/or the number of major and minor tick marks). This routine can be used for either axis.

LEZSHW

LEZTRM

Figure 3-15 shows a bar chart with numeric axes, the independent axis produced using LEZAXN.

The following program generates figure 3-15 by calling only the necessary LEZ routines. This program is shown here in an uncommented form to provide the user with an example of how to use the LEZ routines. A fully commented listing of this program is found in Appendix B.

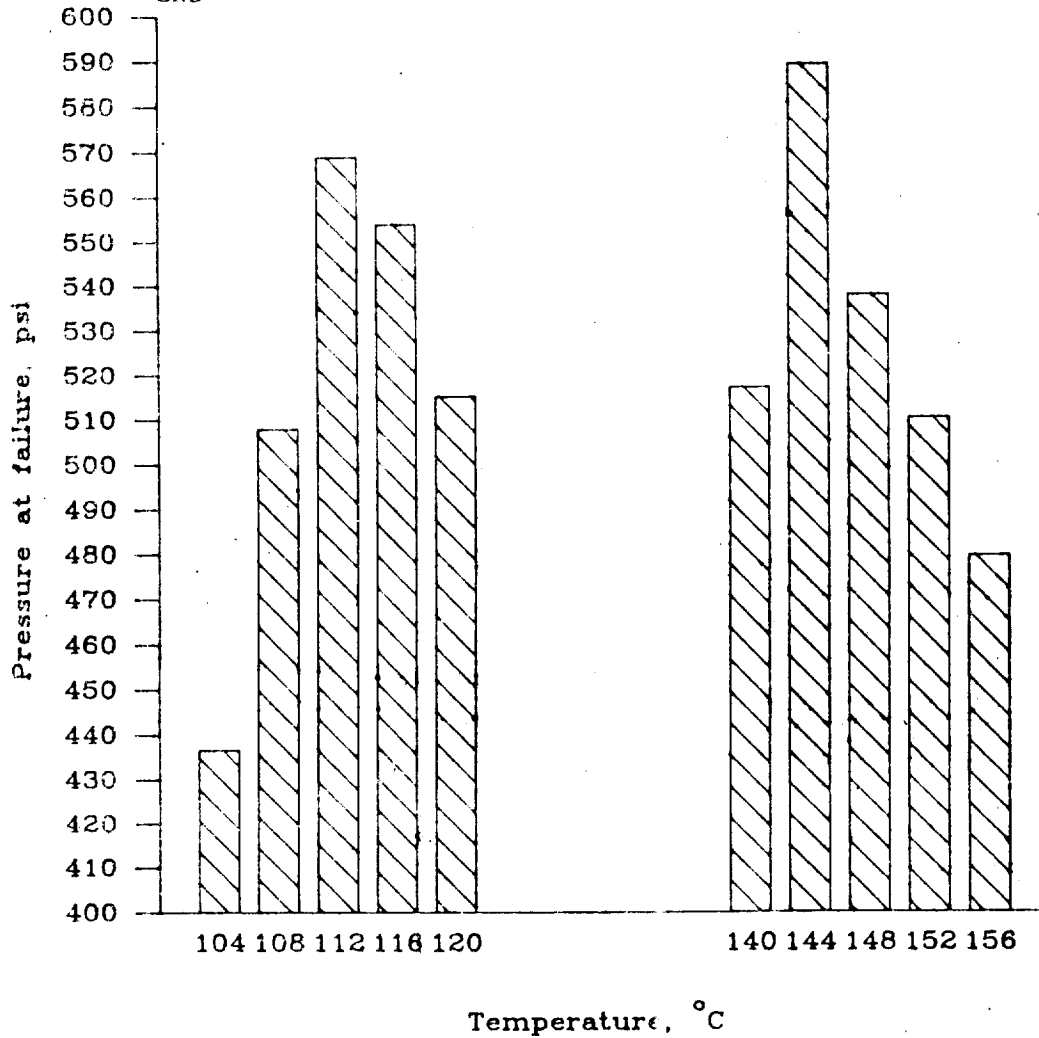
```
PROGRAM DCBAR2
REAL INDMAX,INDMIN,TEMP(10),PRESS(10)
CHARACTER IAXLBL*80,DAXLBL*80,TITLE*80
DATA TEMP /104.,108.,112.,116.,120.,140.,144.,148.,152.,156./
DATA PRESS /436.55,507.95,568.95,554.,515.3,517.25,589.35,537.95,
+          510.45,479.7/
IDEV = 1
CALL LEZINI (IDEV)
NVALS = 10
TITLE = 'L[BLC]OW PRESSURE FATIGUE TESTING'
IAXLBL = 'T[BLC]EMPERATURE, [BSUP]O[ESUP][ELC]C'
DAXLBL = 'P[BLC]RESSURE AT FAILURE, PSI'
INDMIN = 100.
INDMAX = 160.
DEPMIN = 400.
DEPMAX = 600.
INDHV = 1
IBRAPP = 1
CALL LEZBAR(TEMP,PRESS,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+          DEPMIN,DEPMAX,INDHV,IBRAPP)
```

```

IHV = 2
NDEC = -3
TSTART = 400.
TINCR = 10.
TEND = 600.
NTMINR = 0
CALL LEZAXN (IHV,NDEC,TSTART,TINCR,TEND,NTMINR)
CALL LEZNOT('DCBAR2',7.,0.,3,1,0)
CALL LEZSHW
CALL LEZTRM
STOP
END

```

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Low pressure fatigue testing

Figure 3-15. Bar chart with a specified numeric axis.

DCBAR2

Notes.

3.3.4 Bar Chart with a Specified Character Axis (LEZAXT)

It is often desirable to override the default numeric axis labels with character axis labels.

There are only five calls to LEZ routines necessary to obtain a bar chart with a specified character axis without using LEZLBR. The calls necessary are:

LEZINI

LEZBAR

LEZAXT: Overrides the default numeric tick mark labels, and specifies text tick mark labels for an axis. This routine can be used for either or both axes.

LEZSHW

LEZTRM

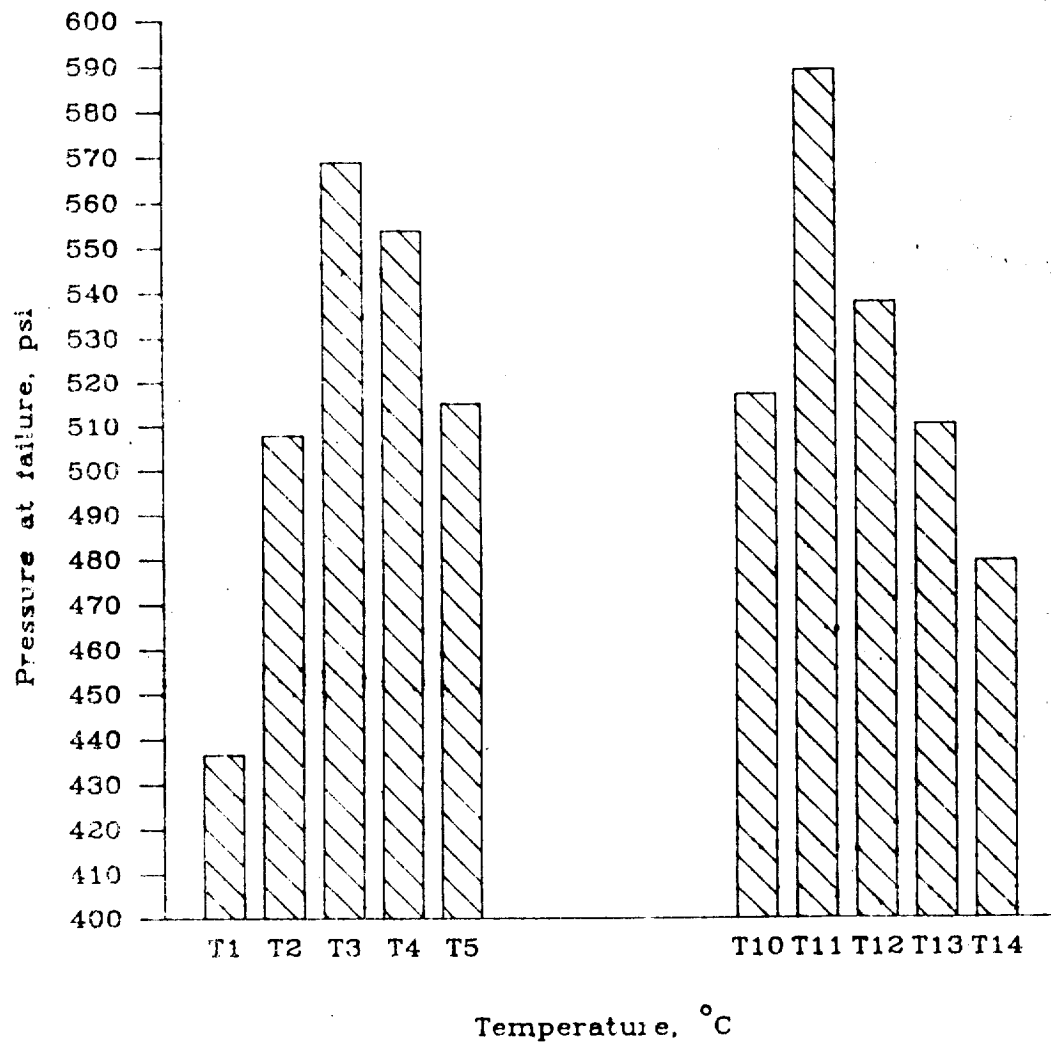
Figure 3-16 shows a bar chart with a character independent axis produced using LEZAXT.

The following program generates figure 3-16 by calling only the necessary LEZ routines. This program is shown here in an uncommented form to provide the user with an example of how to use the LEZ routines. A fully commented listing of this program is found in Appendix B.

```

PROGRAM DCBAR3
REAL      INDMAX,   INDMIN
REAL      TEMP(10), PRESS(10)
CHARACTER*80  IAXLBL,   DAXLBL,   TITLE,   LABELS
DATA TEMP /104.,108.,112.,116.,120.,140.,144.,148.,152.,156./
DATA PRESS /436.55,507.95,568.95,554.,515.3,517.25,589.35,537.95,
+          510.45,479.7/
IDEV = 1
CALL LEZINI (IDEV)
NVALS = 10
TITLE = 'L[BLC]OW PRESSURE FATIGUE TESTING'
IAXLBL = 'T[BLC]EMPERATURE, [BSUP]O[ESUP][ELC]C'
DAXLBL = 'P[BLC]RESSURE AT FAILURE, PSI'
INDMIN = 100.
INDMAX = 160.
DEPMIN = 400.
DEPMAX = 600.
INDHV = 1
IBRAPP = 1
CALL LEZBAR(TEMP,PRESS,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+          DEPMIN,DEPMAX,INDHV,IBRAPP)
IHV = 1
NLABS = 15
LABELS = '$ $T1$T2$T3$T4$T5$ $ $ $ $T10$T11$T12$T13$T14$'
NTMAJR = 16
NTMINR = 1
CALL LEZAXT (IHV,NLABS,LABELS,NTMAJR,NTMINR)
IHV = 2
NDEC = -3
TSTART = 400.
TINCR = 10.
TEND = 600.
NTMINR = 0
CALL LEZAXN (IHV,NDEC,TSTART,TINCR,TEND,NTMINR)
CALL LEZNOT('DCBAR3',7.,0.,3,1,0)
CALL LEZSHW
CALL LEZTRM
STOP
END

```

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DCBAR3

Figure 3-16. Bar chart with a specified character axis (LEZAXT).

3.3.5 Bar Chart with a Character Axis

There are only four calls to the LEZ routines necessary in order to obtain a bar chart with a character axis. The calls necessary are:

LEZINI

LEZLBR: Establishes the chart as a bar chart with evenly spaced bars and text tick mark labels on the independent axis. For the dependent axis, the tick marks are positioned beginning at the input minimums and ending at the input maximums. There are eleven major tick marks on the dependent axis. By default tick marks are drawn on the left of the dependent axis, and not drawn on the independent axis.

LEZSHW

LEZTRM

NOTE: LEZAXT and LEZAXN cannot be used to modify the character axis set up in LEZLBR.

Figure 3-17 shows a bar chart with a character independent axis produced using LEZLBR.

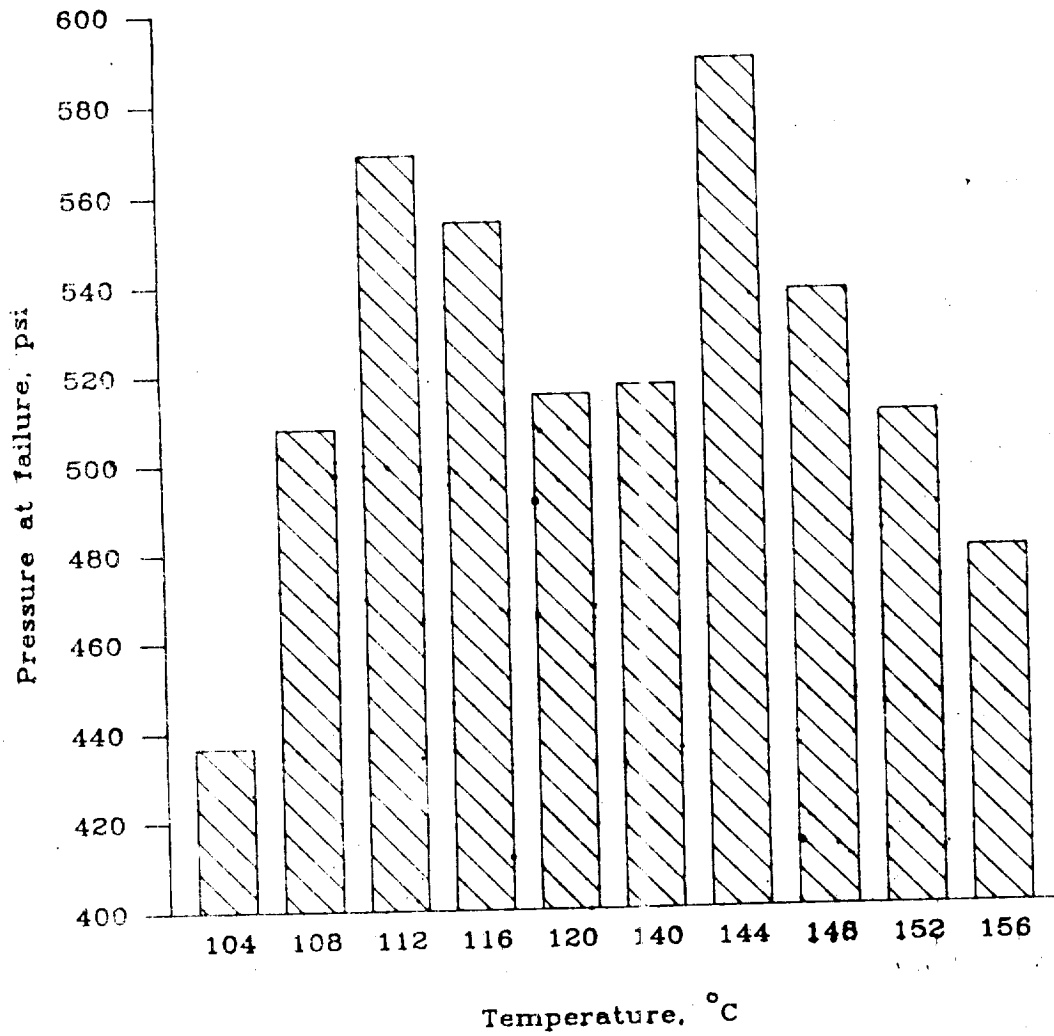
The following program generates figure 3-17 by calling only the necessary LEZ routines. This program is shown here in an uncommented form to provide the user with an example of how to use the LEZ routines. A fully commented listing of this program is found in Appendix B.

```
PROGRAM DCBAR4
REAL      TEMP(10), PRESS(10)
CHARACTER*80 IAXLBL, DAXLBL, TITLE, LABELS
DATA TEMP /104.,108.,112.,116.,120.,140.,144.,148.,152.,156./
DATA PRESS /436.55,507.95,568.95,554.,515.3,517.25,589.35,537.95,
+          510.45,479.7/
IDEV = 1
CALL LEZINI (IDEV)
NVALS = 10
TITLE = 'L[BLC]OW PRESSURE FATIGUE TESTING'
LABELS = '$104$108$112$116$120$140$144$148$152$156$'
IAXLBL = 'T[BLC]EMPERATURE, [BSUP]O[ESUP][ELC]C'
DAXLBL = 'P[BLC]RESSURE AT FAILURE, PSI'
VALMIN = 400.
VALMAX = 600.
INDHV = 1
IBRAPP = 1
CALL LEZLBR(PRESS,NVALS,TITLE,LABELS,IAXLBL,DAXLBL,
+          VALMIN,VALMAX,INDHV,IBRAPP)
```

```

CALL LEZNOT('DCBAR4',7.,0.,3,1,0)
CALL LEZSHW
CALL LEZTRM
STOP
END

```



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DCBAR4

Figure 3-17. Bar chart with a character axis.

Notes.

3.3.6 Bar Chart with a Key

When more than one data set is displayed in the same chart, a key is often used to distinguish the data sets. This section describes how to generate a bar chart with key.

There are only five calls to LEZ routines necessary to obtain a bar chart with a key. The calls necessary are:

LEZINI

LEZBAR or LEZLBR

LEZKEY: Initiates the creation of a key for the chart. There can be only one key per chart. The location of the key is specified in this routine by an XY position about which the key will be justified. The key can be put anywhere on the page, keeping in mind that it will overwrite any plotting done at that position.

LEZDAT: Adds an additional dependent data set to the chart. The relationship among dependent data sets is absolute or additive. If a key is used for the chart, the key entry associated with this data set is supplied by this routine. Note, this routine is optional.

LEZSHW

LEZTRM

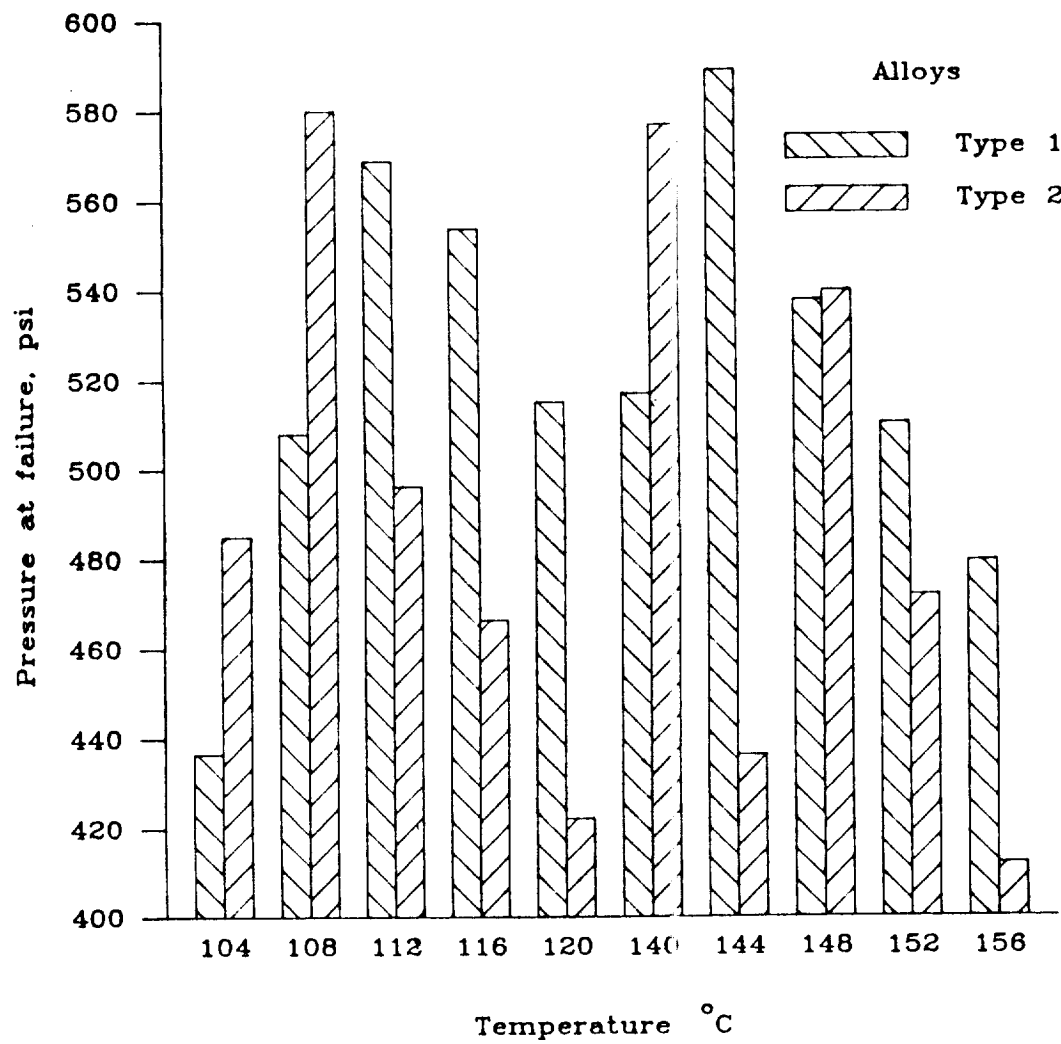
Keys are not necessary unless there is more than one set of data being plotted on the same chart. The additional data sets can be plotted one of two ways on bar charts. The first way is to have additive bars - the bars are plotted one on top of the other. The other way is to have absolute bars - the bars are plotted side-by-side.

The following program generates an absolute bar chart with a key (see figure 3-18). The variable IDTREL of the routine LEZDAT determines whether the data set entered is regarded as absolute or additive. See Appendix A for a complete description of routine LEZDAT.

```

PROGRAM DCBAR5
REAL      TEMP(10), PRES1(10), PRES2(10)
CHARACTER*80  KENTRY,  IAXLBL,  DAXLBL,  TITLE,  LABELS
DATA TEMP /104.,108.,112.,116.,120.,140.,144.,148.,152.,156./
DATA PRES1 /436.55,507.95,568.95,554.,515.3,517.25,589.35,537.95,
+          510.45,479.7/
DATA PRES2 /485.01,580.15,496.33,466.45,422.28,577.16,436.33,
+          540.01,472.03,411.99/
IDEV = 1
CALL LEZINI (IDEV)
NVALS = 10
TITLE = 'L[BLC]OW PRESSURE FATIGUE TESTING'
LABELS = '$104$108$112$116$120$140$144$148$152$156$'
IAXLBL = 'T[BLC]EMPERATURE, [BSUP]0[ESUP][ELC]C'
DAXLBL = 'P[BLC]RESSURE AT FAILURE, PSI'
VALMIN = 400.
VALMAX = 600.0
INDHV = 1
IBRAPP = 1
CALL LEZLBR(PRES1,NVALS,TITLE,LABELS,IAXLBL,DAXLBL,
+          VALMIN,VALMAX,INDHV,IBRAPP)
TITLE = 'A[BLC]LLOYS'
XPOS = 6.5
YPOS = 6.2
KENTRY = 'T[BLC]YPE 1'
CALL LEZKEY (TITLE,XPOS,YPOS,KENTRY)
NVALS = 10
IDTREL = 1
IDTAPP = 1
KENTRY = 'T[BLC]YPE 2'
CALL LEZDAT (PRES2,NVALS,IDTREL,IDTAPP,KENTRY)
CALL LEZNOT('DCBAR5',7.,0.,3,1,0)
CALL LEZSHW
CALL LEZTRM
STOP
END

```



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DCBAR5

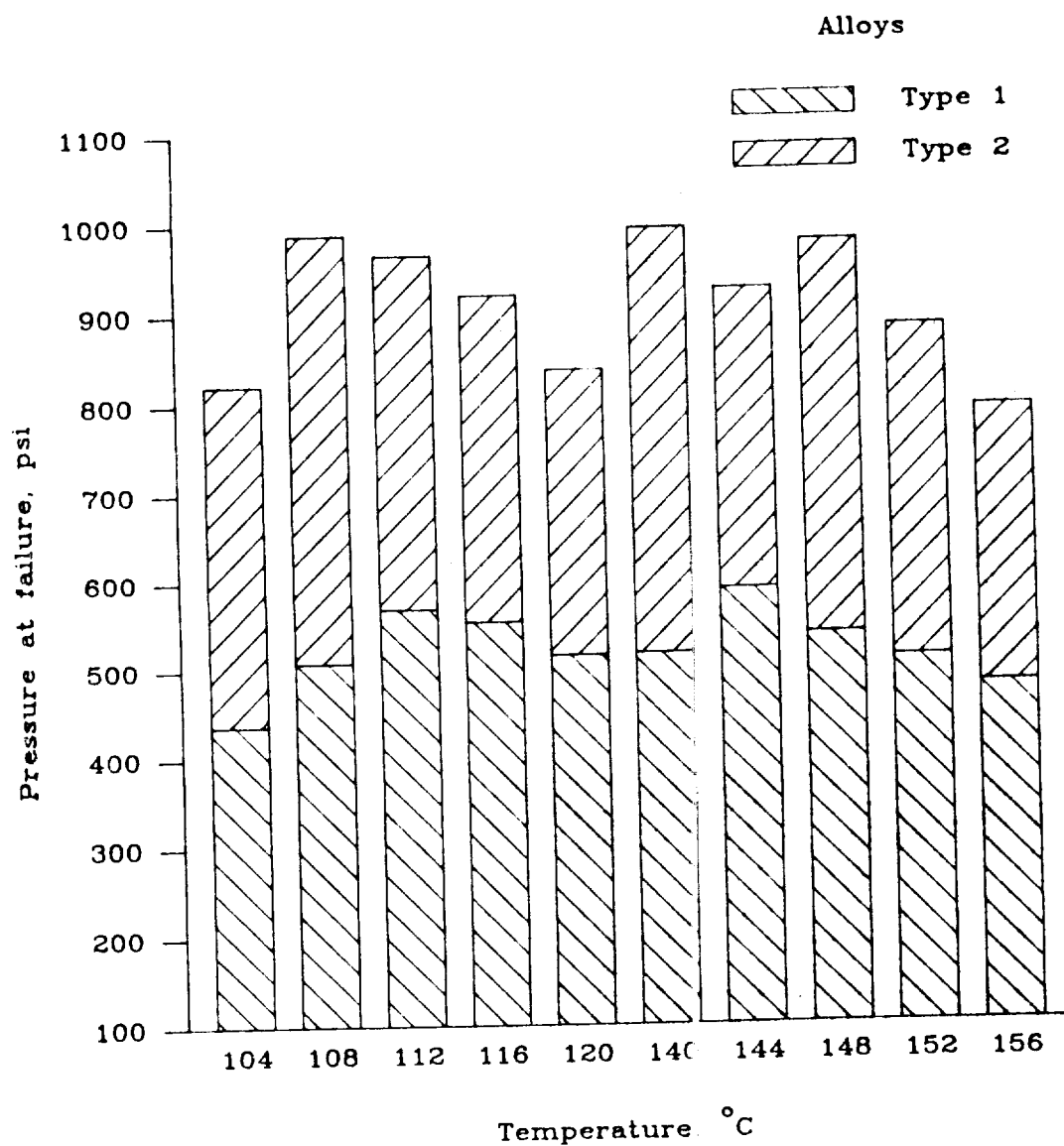
Figure 3-18. Absolute bar chart with a key.

The following program generates an additive bar chart with a key (see figure 3-19). The variable IDTREL of the routine LEZDAT determines whether the data set entered is regarded as absolute or additive. See Appendix A for a complete description of routine LEZDAT.

```

PROGRAM DCBAR6
REAL      TEMP(10), PRES1(10), PRES2(10)
CHARACTER*80  KENTRY,  IAXLBL,  DAXLBL,  TITLE,  LABELS
DATA TEMP /104.,108.,112.,116.,120.,140.,144.,148.,152.,156./
DATA PRES1 /436.55,507.95,568.95,554.,515.3,517.25,589.35,537.95,
+          510.45,479.7/
DATA PRES2 /485.01,580.15,496.33,466.45,422.28,577.16,436.33,
+          540.01,472.03,411.99/
IDEV = 1
CALL LEZINI (IDEV)
NVALS = 10
TITLE = 'L[BLC]OW PRESSURE FATIGUE TESTING'
LABELS = '$104$108$112$116$120$140$144$148$152$156$'
IAXLBL = 'T[BLC]EMPERATURE, [BSUP]O[ESUP][ELC]C'
DAXLBL = 'P[BLC]RESSURE AT FAILURE, PSI'
VALMIN = 100.
VALMAX = 1100.0
INDHV = 1
IBRAPP = 1
CALL LEZLBR(PRES1,NVALS,TITLE,LABELS,IAXLBL,DAXLBL,
+          VALMIN,VALMAX,INDHV,IBRAPP)
TITLE = 'A[BLC]LLOYS'
XPOS = 6.2
YPOS = 7.0
KENTRY = 'T[BLC]YPE 1'
CALL LEZKEY (TITLE,XPOS,YPOS,KENTRY)
NVALS = 10
IDTREL = 2
IDTAPP = 1
KENTRY = 'T[BLC]YPE 2'
CALL LEZDAT (PRES2,NVALS,IDTREL,IDTAPP,KENTRY)
CALL LEZNOT('DCBAR6',7.,0.,3,1,0)
CALL LEZSHW
CALL LEZTRM
STOP
END

```

Low pressure fatigue testing

DCBAR6

Figure 3-19. Additive bar chart with a key.

3.3.7 Bar Chart Options

The routine LEZOPT provides a variety of options which enable the user to override the default chart appearance. Table 3-2 lists these options in alphabetical order. Additionally, this table includes the corresponding initial defaults. Examples using many of these options are found in Appendix B.

<u>Option</u>	<u>Description</u>	<u>Type</u>	<u>Default value</u>
CLEAR	To clear the screen or not	LOGICAL .TRUE. - to clear .FALSE. - not to clear	.TRUE. (to clear)
COLOR	Interior colors and line colors	Array of INTEGERS (see DI-3000 color table)	1 through 8 (cycled)
DASH	Dashed lines	LOGICAL .TRUE. - to dash .FALSE. - not to dash	.FALSE. (not to dash)
HAXLEN	Horizontal axis length	REAL	2/3 * page width
HTICPOS	Horizontal tick mark positioning	INTEGER 0 - tick marks suppressed 1 - inside data space 2 - outside of data space 3 - both inside and outside	1 (above the axis)
HTLABR	Horizontal tick mark rotation	INTEGER	0 degrees
INTPAT	Interior patterns	Array of INTEGERS (see DI-3000 interior patterns)	15, 16, 18, 27, 28, 30, 39, 40 (cycled)
KEYJUST	Key justification	INTEGER 1 - lower left 2 - lower right 3 - upper left 4 - upper right	4 (Upper right)

Table 3-2. LEZOPT options for bar charts.

<u>Option</u>	<u>Description</u>	<u>Type</u>	<u>Default value</u>
PAUSE	To pause the screen or not	LOGICAL .TRUE. - to pause FALSE. - not to pause	.TRUE. (to pause)
RTAXIS	To draw a "right" axis	LOGICAL TRUE. - to draw axis FALSE. - not to draw axis	.FALSE. (not to draw axis)
VAXLEN	Vertical axis length	REAL	2/3 * page height
VLABDR	Vertical axis label direction	LOGICAL TRUE. - horizontal direction FALSE.- vertical direction	.FALSE. (vertical direction)
VTLABR	Vertical tick mark rotation	INTEGER	0 degrees
VTICPOS	Vertical tick mark positioning	INTEGER 0 - tick marks suppressed 1 - inside data space 2 - outside data space 3 - both inside and outside	1 (right of the axis)
XORIGIN	X-origin of the data space	REAL	2/9 * page width
YORIGIN	Y-origin of the data space	REAL	2/9 * page height

Table 3-2. LEZOPT options for bar charts (continued).

Notes.

3.4 Pie Charts

All pie charts generated by the LEZ routines follow the previously described sequence of subroutine calls as shown in figure 3-2.

The LEZPIE routine draws a pie chart with or without exploded segments, and with quantity and/or percentage labels optionally displayed. There are two ways to denote information about pie segments. The first way is to put text labels on each pie segment. This is done by calling the LEZPLB routine once for each pie segment in the pie chart. The second way to denote pie segment information is by the use of a key. A call to the routine LEZKEY establishes the key position, the key title, and the text for the first key entry. To input the text for the remaining pie segments LEZPLB must be called for each desired pie segment. Text labels for each pie segment are preferred if the chart is to be informative and clear. For this reason, it is strongly recommended that either LEZPLB and/or LEZKEY always be used when making pie charts.

For a description and example of pie segment labels see Section 2 (Basic Terms and Concepts).

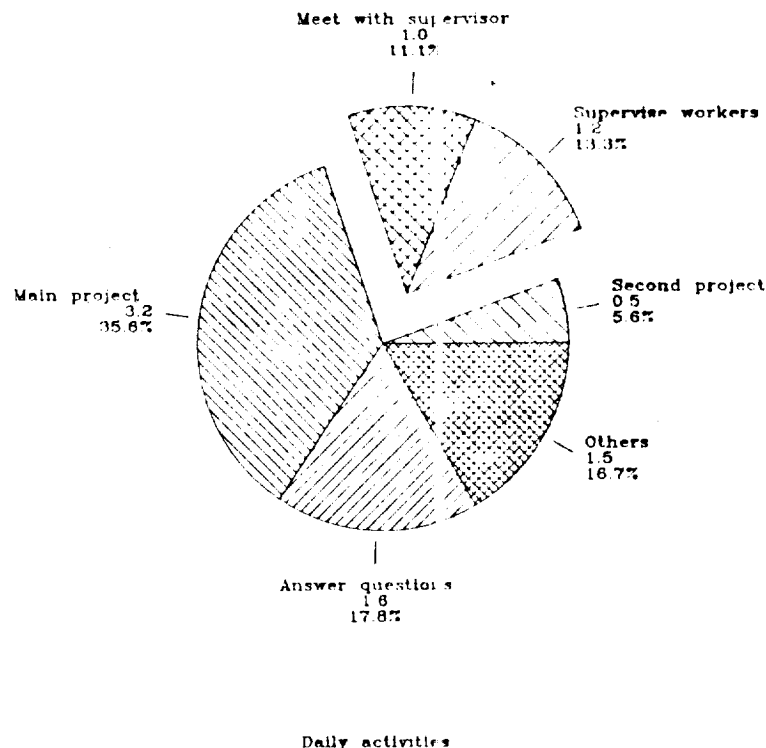


Figure 3-20. Pie chart example.

DCPIE2

3.4.1 Steps Required to Generate Pie Charts

Figure 3-21 shows a flow chart of the order in which the LEZ routines should be called to produce a pie chart. The optional routines LEZPGE (which sets the page size), LEZFIL (which sets the error and debug destinations), and LEZDB (which sets the debug level) will be described in Section 3.6.

The following subsections (i.e., 3.4.2 through 3.4.4) provide an overview of the necessary and optional routines available to generate a pie chart. The following pages provide a worded outline of how to produce various types of the basic pie chart. The routine names in bold are those which are of primary interest in that subsection. Unless otherwise stated, the pie charts shown in this section were produced by using only the necessary LEZ routines. The user is referred to Appendix A for a complete description of the LEZ routines, and their associated arguments. These examples, along with additional ones, appear in Appendix B with a listing of the source code which produced them.

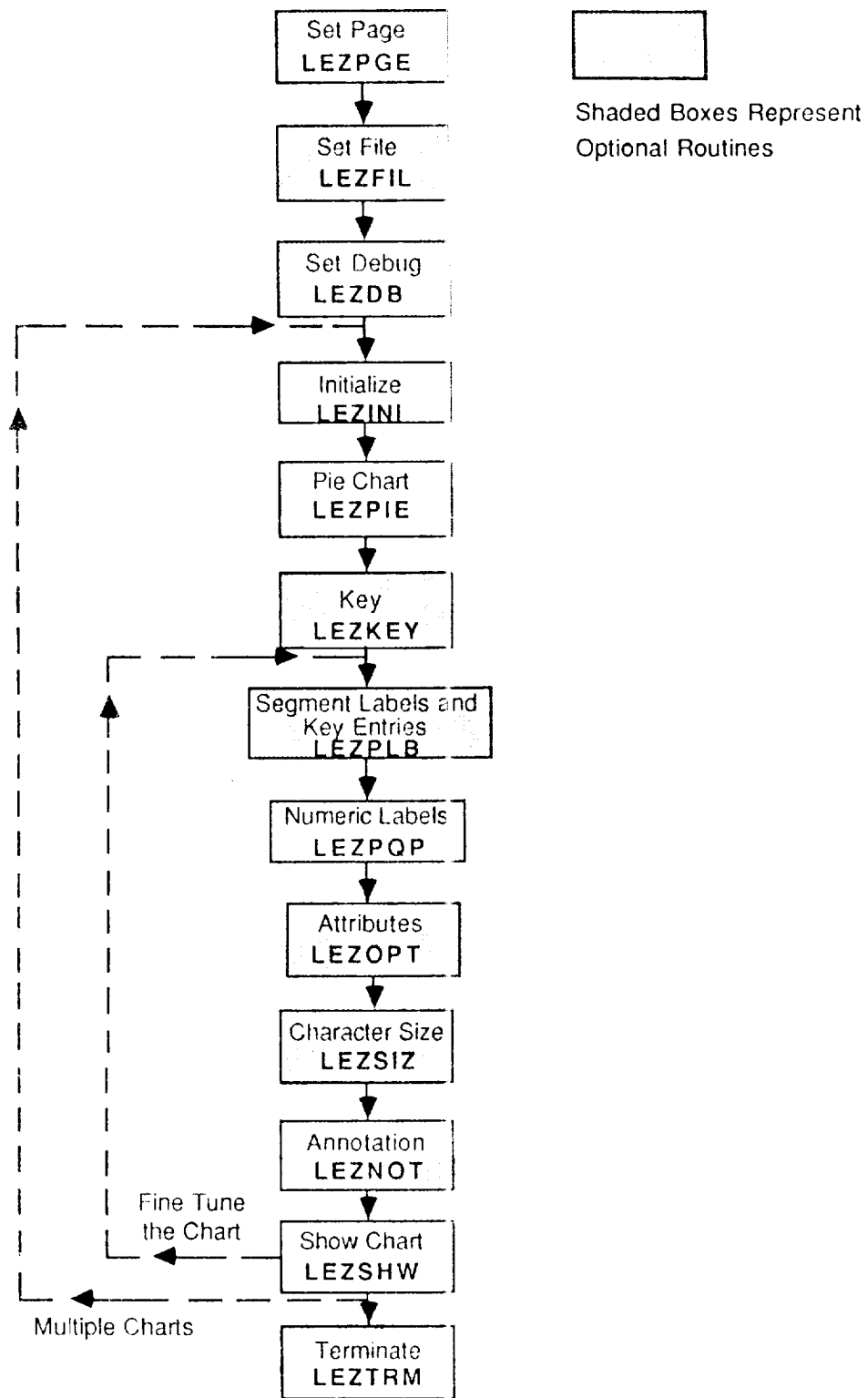


Figure 3-21. The sequence of LEZ calls to generate a pie chart.

The following section provides a brief description of the LEZ routines pertaining to the pie charts. A more detailed description for each is given in Appendix A as well as illustrated in the following subsections. The following descriptions are intended to acquaint the user with the LEZ interface.

- LEZPIE:** Establishes the chart as a pie chart. There is a limit of ten segments per pie chart. By default, labels are not plotted by each pie segment. Quantity and percent labels can be optionally displayed by inputting the appropriate values into the routine.
- LEZKEY:** Initiates the creation of a key for the chart. There can be only one key per chart. The location of the key is specified in this routine by an XY position about which the key will be justified. The key can be put anywhere on the page, keeping in mind that it will overwrite any plotting done at that position.
- LEZPLB:** Labels a pie segment with a text label and/or makes a key entry. A call to this routine, for each pie segment, is the only way a segment will have a text label or a key entry. If a key is used for the chart LEZPLB must be used to input all but the first key entry (which is entered through LEZPIE).
- LEZPQP:** Changes the default format for the quantity and percent labels for pie segments. The formats can be any valid FORTRAN format specification. If the value cannot be plotted with the specification, the field for that value will be filled with asterisks.
- LEZOPT:** Sets options to change the appearance of the current chart. Once the attributes have been changed, the new values are used for all charts until they are changed again either by calling LEZOPT again or by calling LEZINI.
- LEZSIZ:** Changes the height, width, and gap of the text. This routine changes the size of the text used during the generation of the chart. This size remains in force until LEZSIZ is called again or LEZINI is called (resetting the text characteristics back to the defaults).

LEZNOT: Defines and positions a note on the current chart. The note is displayed when LEZNOT is called, not in LEZSHW with the rest of the chart. The note may be placed anywhere on the page and may be rotated about an XY position about which the note will be justified.

LEZSIZ may be called prior to this routine to change the text height, width, and gap. When refining the chart, if the screen is cleared after LEZSHW is called the notes must be input again if they are to appear on the chart after the second call to LEZSHW.

3.4.2 Pie Chart with Segment Labels

This section describes how to generate a basic pie chart with pie segment labels.

There are only five calls to the LEZ routines necessary in order to obtain a pie chart with segment labels. The calls necessary are:

LEZINI

LEZPIE: Establishes the chart as a pie chart. There is a limit of ten segments per pie chart. Pie segment text labels are only displayed by calling LEZPLB for each segment. Quantity and percent labels can be optionally displayed inputting the appropriate values into the routine.

LEZPLB: Labels a pie segment with a text label and/or makes a key entry. A call to this routine, for each pie segment, is the only way a segment will have a text label or a key entry. If a key is used for the chart LEZPLB must be used to input all but the first key entry (which is entered through LEZPIE).

LEZSHW

LEZTRM

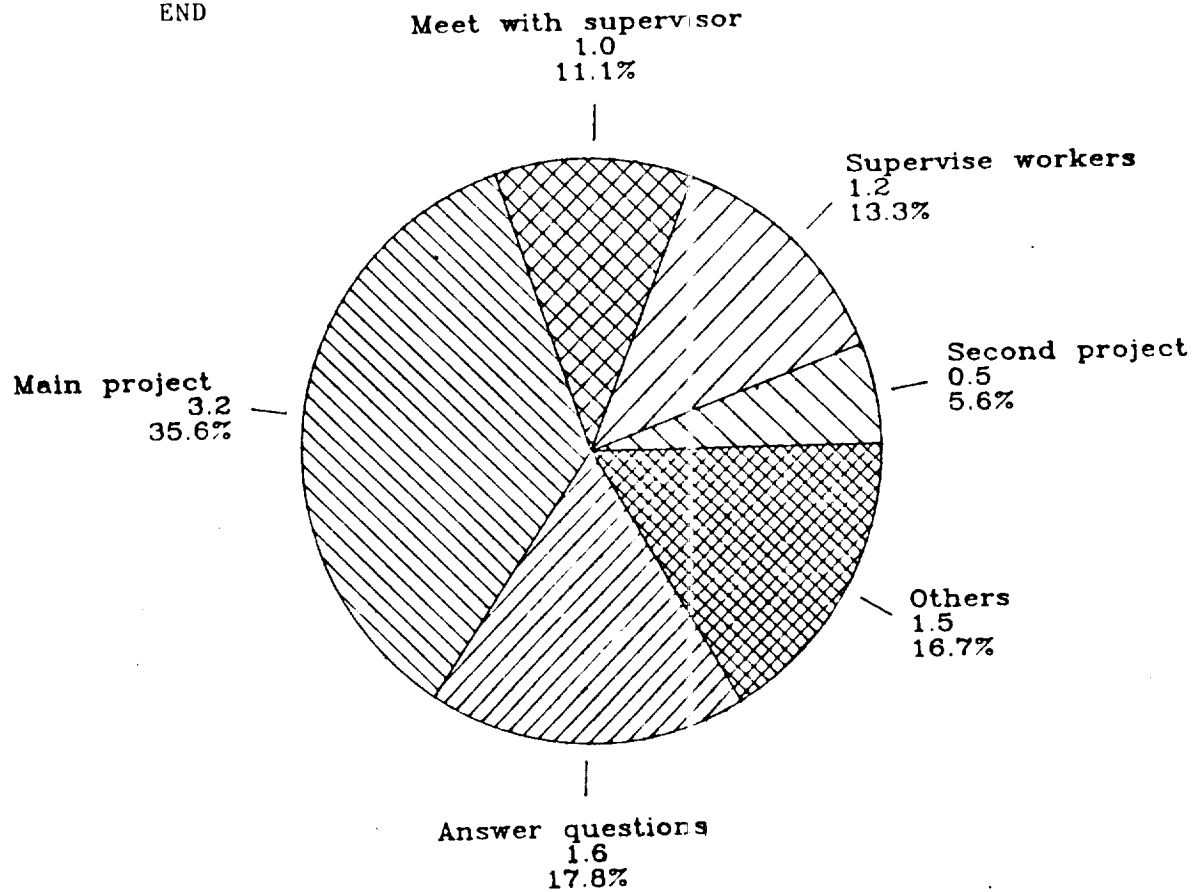
The following program generates figure 3-22 using the necessary calls to the LEZ routines. This program is shown here in an uncommented form to provide the user with an example of how to use the LEZ routines. A fully commented listing of this program is found in Appendix B.

The following program generates a pie chart with pie segment text labels. The routine LEZPLB determines if a pie segment is to have a text label. See Appendix A for a complete description of LEZPLB.

```
PROGRAM DCPIEL
REAL SEGS(6)
CHARACTER*80  TITLE,  KENTRY,  LABEL,  KEY
DATA SEGS/0.5, 1.2, 1.0, 3.2, 1.6, 1.5/
IDEV = 1
CALL LEZINI (IDEV)
TITLE = 'D[BLC]AILY ACTIVITIES'
NUM = 6
NEXP1 = 0
NEXP2 = 0
LFORM1 = 1
LFORM2 = 1
```

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```
CALL LEZPIE (SEGS,NUM,TITLE,NEXP1,NEXP2,LFORM1,LFORM2)
NOPLB = 4
LABEL = 'M[BLC]AIN PROJECT'
KEY = ' '
CALL LEZPLB (NOPLB,LABEL,KEY)
CALL LEZPLB (1,'S[BLC]ECOND PROJECT',' ')
CALL LEZPLB (6,'O[BLC]THERS',' ')
CALL LEZPLB (2,'S[BLC]UPERVISE WORKERS',' ')
CALL LEZPLB (3,'M[BLC]EET WITH SUPERVISOR',' ')
CALL LEZPLB (5,'A[BLC]NSWER QUESTIONS',' ')
CALL LEZNOT('DCPIE1',7.,0.,3,1,0)
CALL LEZSHW
CALL LEZTRM
STOP
END
```



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Figure 3-22. Pie chart with segment labels.

DCPIE1

3.4.3 Pie Chart with Exploded Pie Segments

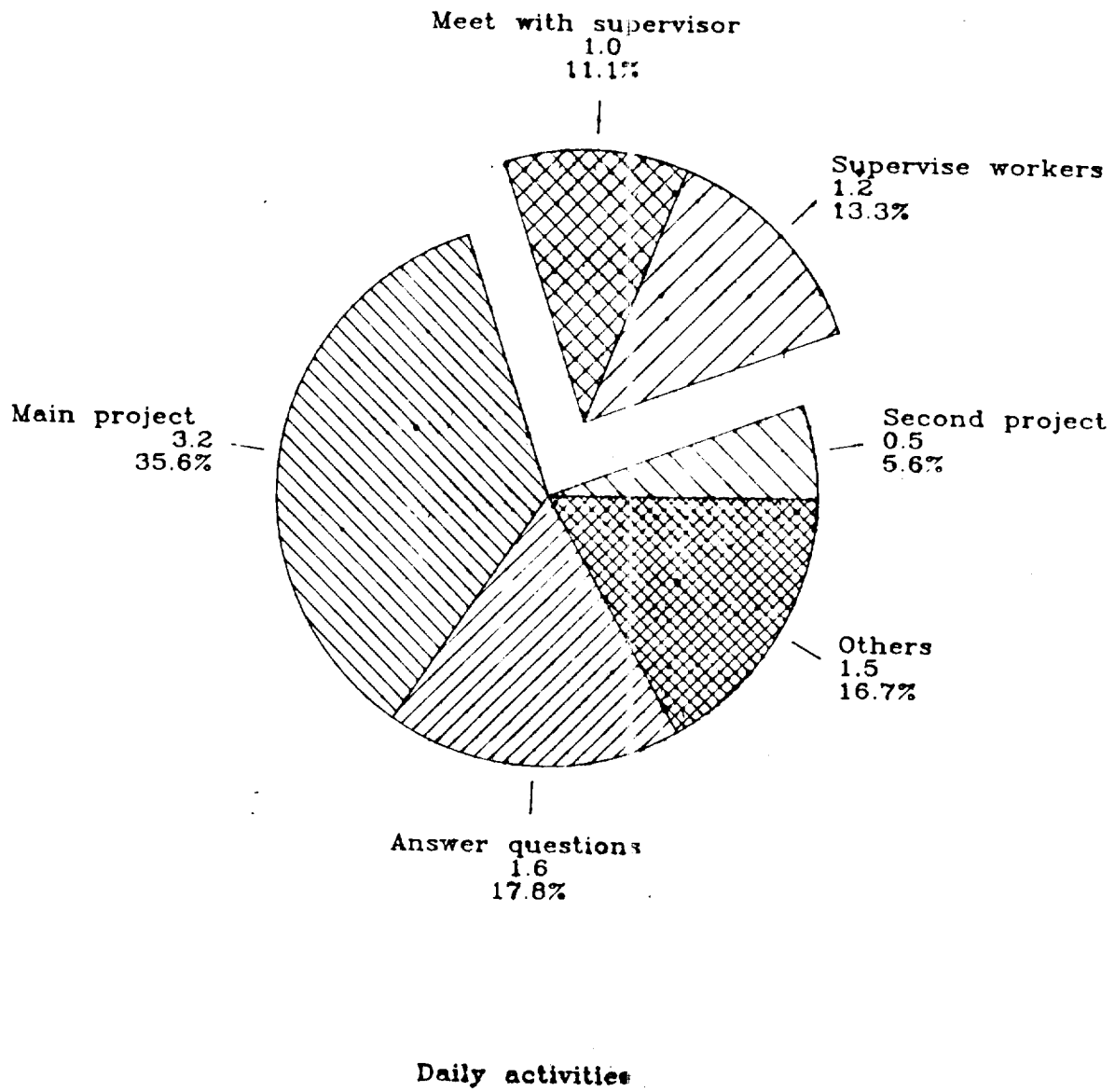
This section describes how to generate a pie chart with exploded pie segments. Exploded segments are segments which are offset from the center of the pie. These segments are used to emphasize a portion of the overall. For a description and example of exploded segments, see section 2 (Basic Terms and Concepts).

To explode a pie segment (i.e., partially remove segments from the whole pie), the user must pass the starting and ending segments number via the NEXP1 and NEXP2 variables in routine LEZPIE (see Appendix A for a complete description of LEZPIE).

The following program generates figure 3-23 by calling only the necessary LEZ routines. This program is shown here in an uncommented form to provide the user with an example of how to use the LEZ routines. A fully commented listing of this program is found in Appendix B.

```
PROGRAM DCPIE2
REAL SEGS(6)
CHARACTER*80  TITLE,  KENTRY,  LABEL,  KEY
DATA SEGS/0.5, 1.2, 1.0, 3.2, 1.6, 1.5/
IDEV = 1
CALL LEZINI (IDEV)
TITLE = 'D[BLC]AILY ACTIVITIES'
NUM = 6
NEXP1 = 2
NEXP2 = 3
LFORM1 = 1
LFORM2 = 1
CALL LEZPIE (SEGS,NUM,TITLE,NEXP1,NEXP2,LFORM1,LFORM2)
NOPLB = 4
LABEL = 'M[BLC]AIN PROJECT'
KEY = ' '
CALL LEZPLB (NOPLB,LABEL,KEY)
CALL LEZPLB (1,'S[BLC]ECOND PROJECT',' ')
CALL LEZPLB (6,'O[BLC]THERS',' ')
CALL LEZPLB (2,'S[BLC]UPERVISE WORKERS',' ')
CALL LEZPLB (3,'M[BLC]EET WITH SUPERVISOR',' ')
CALL LEZPLB (5,'A[BLC]NSWER QUESTIONS',' ')
CALL LEZNOT('DCPIE2',7.,0.,3,1,0)
CALL LEZSHW
CALL LEZTRM
STOP
END
```

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DCPIE2

Figure 3-23. Pie chart with exploded segments.

Notes.

3.4.4 Pie Chart with a Key

A key is often desired to provide information concerning each pie segment.

There are only six calls to the LEZ routines necessary in order to obtain a pie chart with a key. The calls necessary are:

LEZINI

LEZPIE

LEZKEY: Initiates the creation of a key for the chart. There can be only one key per chart. The location of the key is specified in this routine by an XY position about which the key will be justified. The key can be put anywhere on the page, keeping in mind that it will overwrite any plotting done at that position.

LEZPLB: Labels a pie segment with a text label and/or makes a key or key entry. A call to this routine, for each pie segment, is the only way a segment will have a text label or a key entry. If a key is used for the chart LEZPLB must be used to input all but the first key entry.

LEZSHW

LEZTRM

Figure 3-24 shows a pie chart with a key. Quantity and percent labels for each pie segment are displayed, but pie segment text labels are not displayed in this chart.

The following program generates figure 3-24 by calling only the necessary LEZ routines. This program is shown here in an uncommented form to provide the user with an example of how to use the LEZ routines. A fully commented listing of this program is found in Appendix B.

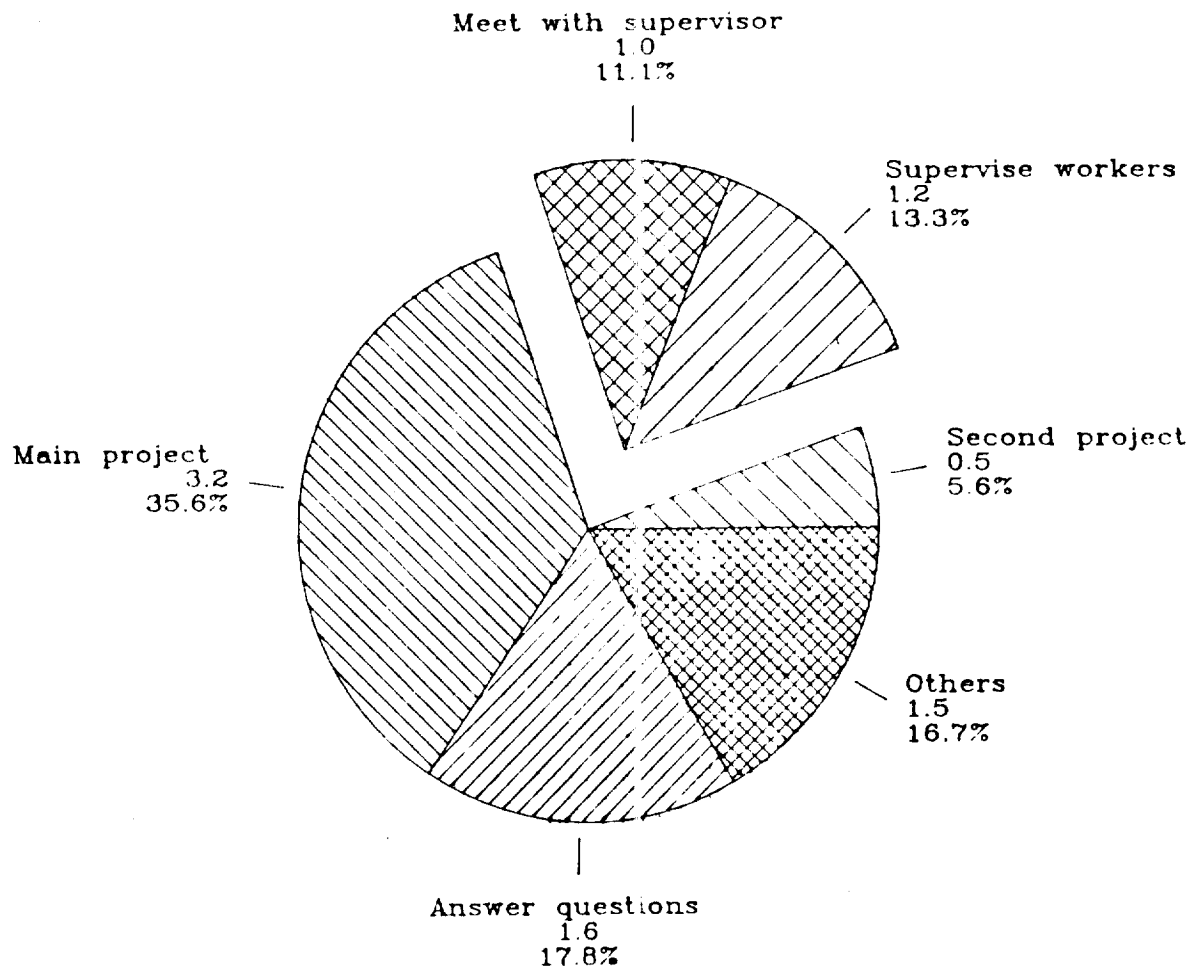
```

PROGRAM DCPIE3
REAL SEGS(6)
CHARACTER*80  TITLE,  KENTRY,  LABEL,  KEY
DATA SEGS/0.5, 1.2, 1.0, 3.2, 1.6, 1.5/
IDEV = 1
CALL LEZINI (IDEV)
TITLE = 'D[BLC]AILY ACTIVITIES'
NUM = 6
NEXP1 = 0
NEXP2 = 0
LFORM1 = 1
LFORM2 = 1
CALL LEZPIE (SEGS,NUM,TITLE,NEXP1,NEXP2,LFORM1,LFORM2)
TITLE = 'P[BLC]RESENT RESPONSIBILITIES'
XPOS = 3.3
YPOS = 7.0
KENTRY = 'S[BLC]ECOND PROJEKT'
CALL LEZKEY (TITLE,XPOS,YPOS,KENTRY)
NOPLB = 4
LABEL = ' '
KEY = 'M[BLC]AIN PROJECT'
CALL LEZPLB (NOPLB,LABEL,KEY)
CALL LEZPLB (1,' ', 'S[BLC]ECOND PROJEKT')
CALL LEZPLB (6,' ', 'O[BLC]THERS')
CALL LEZPLB (2,' ', 'S[BLC]UPERVISE WORKERS')
CALL LEZPLB (3,' ', 'M[BLC]EET WITH SUPERVISOR')
CALL LEZPLB (5,' ', 'A[BLC]NSWER QUESTIONS')
CALL LEZNOT('DCPIE3',7.,0.,3,1,0)
CALL LEZSHW
CALL LEZTRM
STOP
END

```

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Daily activities

DCPIE2

Figure 3-24. Pie chart with a key.

3.4.5 Pie Chart Options

The routine LEZOPT provides a variety of options which enable the user to override the default chart appearance. Table 3-3 lists these options in alphabetical order. Additionally, this table includes the corresponding initial defaults. Examples using many of these options are found in Appendix B.

<u>Option</u>	<u>Description</u>	<u>Type</u>	<u>Default value</u>
BFILLD	Whether to fill pie segments	Array of INTEGERS 0 - do not fill 1 - fill	1 (fill)
CLEAR	To clear the screen or not	LOGICAL .TRUE. - to clear .FALSE. - not to clear	.TRUE. (to clear)
COLOR	Interior colors and line colors	Array of INTEGERS (see DI-3000 color table)	1 thru 8 (cycled)
INTPAT	Interior patterns	Array of INTEGERS (see DI-3000 interior patterns)	15, 16, 18, 27, 28, 30, 39, 40 (cycled)
KEYJUST	Key justification	INTEGER 1 - lower left 2 - lower right 3 - upper left 4 - upper right	4 (Upper right)
PAUSE	To pause the screen or not	LOGICAL .TRUE. - to pause .FALSE. - not to pause	.TRUE. (to pause)
RADIUS	Radius of pie	REAL	2/9 * smallest page dimension
XORIGIN	X-origin of the data space	REAL	2/9 * page width
YORIGIN	Y-origin of the data space	REAL	2/9 * page height

Table 3-3. LEZOPT options for pie charts.

3.5 Composite Charts

This section provides a worded outline of how to produce **composite chart**. A composite chart is a collection of two or more line charts, bar charts, and pie charts on a single frame. An example of a composite chart and its corresponding program is presented. Additional complex charts appear in Appendix B along with a listing of the corresponding source code.

3.5.1 Considerations Needed in Planning Composite Charts

A composite chart is one that contains two or more charts on one page. The number of charts and the size of each chart must be carefully considered when planning the overall layout. The page size limits the number and size of charts possible on the page. There are several approaches which can be taken when generating composite charts.

The first thing that must be determined is the page size on which the charts are to be plotted. The default page size is 7.0 X 7.0 *units*. These units can be thought of as inches if desired. The page size can only be changed once at the beginning of the graphics session by calling LEZPGE. All of the chart components involving size and distances (e.g., character height, axes height, axes lengths, symbol sizes, etc.) are scaled based on the page size, to display a single chart maximizing the use of the page area. The page size should be large enough to contain all the charts and any keys and/or notes desired on the chart.

It is recommended that the page be conceptually divided up into regions, one region for each chart. That way each chart can be manipulated to fit into the available area. The order of calls to the LEZ routines is the same as for a single chart per page. However, certain options will probably be used when generating composite charts.

Note that the calls to the LEZ routines are for one chart at a time with at least one call to LEZSHW between each chart. This means the screen is cleared after it is shown. When plotting multiple charts per page, the user must turn off the "clearing" and "pausing" capabilities in LEZSHW by using the PAUSE and CLEAR options in LEZOPT. For example, suppose there are "n" charts on one page, the pausing and clearing options must be turned off for the first "n-1" charts, and turned on for the "nth" chart. Otherwise the "n" charts will not appear on the same page.

There can be calls to LEZINI between each chart, which will reinitialize the LEZ and CGL variables allowing the user to define another chart. There must not be any calls to LEZTRM between charts. If LEZTRM is called between charts, the graphics session will be terminated and the composite chart will not be produced. LEZTRM should only be called once as the very last routine called to end the graphics session.

3.5.2 Steps Required to Generate Composite Charts

Figure 3-25 shows a flow chart of the order in which the LEZ routines should be called to produce a composite chart. The optional routines LEZPGE (which sets the page size), LEZFIL (which sets the error and debug destinations), and LEZDB (which sets the debug level) will be described in detail later in this document.

The following subsections provide an overview of the necessary routines available to generate a composite chart. The following pages provide a worded outline of how to produce a composite chart. The routine names in bold are those which are of primary interest in that subsection. Unless otherwise stated, the composite charts shown in this section were produced by using only the necessary LEZ routines. The user is referred to Appendix A for a complete description of the LEZ routines, and their associated arguments. These examples, along with additional ones, appear in Appendix B, with a listing of the source code which produced them.

LEZPGE Changes the default page size. This must be the first LEZ routine called by the application program, and can only be called once during a graphics session. After LEZTRM has been called, this routine can be called again.

This routine can be particularly useful in generating composite charts, by enabling the user to define a specific page area on which to position multiple charts.

LEZINI: Initialize the Common Graphics Library and the underlying graphics package. Sets the necessary defaults and indicates where the chart is to be drawn (metafile, screen, or both). The default page size is 7.0 -by-7.0 inches.

The call to LEZINI will reset the majority of LEZ and CGL related variables. It is therefore necessary to establish each subsequent chart independent from any attributes which may have been used in previous charts (e.g., the chart type, the axis length, the axis origin, etc.).

LEZOPT: Sets options to change the appearance of the current chart. Once the attributes have been changed, the new values are used for all charts until they are changed again either by calling LEZOPT again or by calling LEZINI. A complete list of options is given in Appendix A under LEZOPT.

This routine provides two options which enable the user to generate composite charts: **PAUSE** and **CLEAR**. The PAUSE and CLEAR options allow the user to disable the pausing and clearing of the page (screen) such that additional charts can be produced. Thus, for the first **nth-1** charts, the CLEAR option should be disabled. On the last chart (the **nth** chart), the PAUSE and CLEAR option should be enabled.

LEZSIZ: Changes the height, width, and gap of the text. This routine changes the size of the text to be plotted after it is called until this routine is called again or LEZINI is called.

LEZNOT: Defines and positions a note on the current chart. The note is displayed when LEZNOT is called, not in LEZSHW with the rest of the chart. The note may be placed anywhere on the page and may be rotated about its justification point by any whole angle amount.

LEZSIZ may be called prior to this routine to change the text height, width, and gap. When refining the chart, if the screen is cleared after LEZSHW is called the notes must be input again if they are to appear on the chart after LEZSHW is called again.

LEZSHW: Draws the chart as it is currently defined by all previous LEZ calls. This routine may be called more than once between LEZINI and LEZTRM. This allows the user to view the chart as each new annotation and/or refinement is specified.

The user can refine the chart by making more calls to the LEZ

routines or the user can terminate the graphics session by calling LEZTRM.

LEZTRM: Ensures that all graphics output is complete and terminates the Common Graphics Library and the underlying graphics package support systems. This must be the last LEZ routine called by the applications program. LEZINI may be called again after LEZTRM to start another creation of another chart.

The use of LEZTRM will end and rewind the metafile. Therefore, if multiple frame (i.e., plots) are to be written to a metafile, then LEZTRM should be called after the last chart is generated.

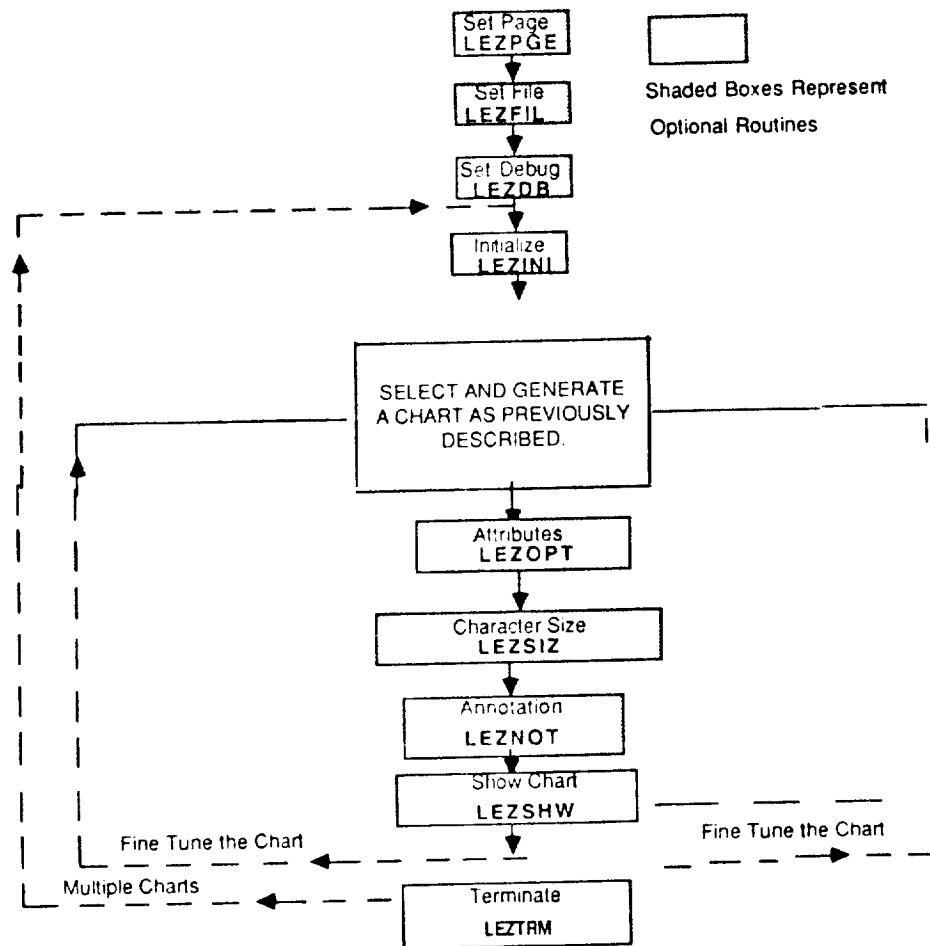


Figure 3-25. The sequence of LEZ calls to generate a composite chart.

3.5.3 Example of a Composite Chart

The following program generates a composite chart (i.e., multiple charts per page). This program is intentionally commented sparingly so the user can focus on the aspects necessary to construct a composite chart. Appendix B contains the identical program, except fully commented.

The user should note the calls to LEZOPT just before the first LEZSHW. Specifically, the call to the PAUSE and CLEAR options enable multiple charts to be written on the same page without intervening pauses and clears. Additionally, the user should recognize the need to alter the axes lengths (the LEZOPT option VAXLEN), and the need to reposition the axis (the LEZOPT option YORIGIN). This example is intended only to provide an overview of the calling sequence. The user is referred to Appendix A for a complete description of the LEZ routines, and Appendix B for further examples of composite charts.

```
PROGRAM DCMIX1
CHARACTER TITLE*256, IAXLBL*80, DAXLBL*80, KENTRY*80
REAL SPAN(25), CLIFT(25), CDRAG(25), CMOMNT(25), INDMIN, INDMAX
DATA CLIFT/.4748,.6962,.8165,.9102,.9631,1.005,1.063,1.112,
+1.146,1.170,1.187,1.199,1.207,1.210,1.209,1.203,1.193,1.180,
+1.163,1.142,1.117,1.094,1.076,1.028,.5721/
DATA CDRAG/.1674,.2426,.2827,.3137,.3307,.3439,.3629,.3789,
+.3897,.3971,.4021,.4056,.4077,.4084,.4076,.4054,.4020,.3975,
+.3919,.3852,.3776,.3705,.3652,.3519,.3038/
DATA CMOMNT/-.3639,-.4936,-.5337,-.5454,-.5263,-.4971,-.4704,
+-.4348,-.3902,-.3404,-.2878,-.2376,-.1790,-.1246,-.07136,
+-.02016,.02818,.07293,.1133,.1484,.1774,.2022,.2261,.2264,-.06216/
RI=-1.0
DO 1 I=1,25
  RI=RI+.04
  SPAN(I)=RI
1 IDEV=1
CALL LEZINI(IDEV)
NVALS=25
TITLE='V[BLC]ORTEX FLOW ABOUT A 60[BSUP]O[ESUP] DELTA WING'
IAXLBL='[BLC]2Y/B'
DAXLBL='P[BLC]ROPERTIES FOR [FONT=9][BLC]A[FONT]=20[BSUP]O'
INDMIN=1.
INDMAX=1.
DEPMIN=0.
DEPMAX=0.
INDHV=1
LINAPP=1
CALL LEZLIN(SPAN,CLIFT,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+DEPMIN,DEPMAX,INDHV,LINAPP)
```

```

NVALS=25
IDTREL=1
LINAPP=1
KENTRY='C[BSUB][BLC]D'
CALL LEZDAT(CDRAG,NVALS,IDTREL,LINAPP,KENTRY)
NVALS=25
IDTREL=1
LINAPP=1
KENTRY='C[BSUB][BLC]M'
CALL LEZDAT(CMOMNT,NVALS,IDTREL,LINAPP,KENTRY)
CALL LEZOPT('PAUSE',0)
CALL LEZOPT('CLEAR',0)
VAXLEN=2.
CALL LEZOPT('VAXLEN',VAXLEN)
YORG=1.2
CALL LEZOPT('YORIGIN',YORG)
CALL LEZSHW
DO 2 I=1,25
CDRAG(I)=CDRAG(I)-(SQRT(ABS(CDRAG(I))))+.7
CMOMNT(I)=CMOMNT(I)-(SQRT(ABS(CMOMNT(I))))+.3
2 CLIFT(I)=CLIFT(I)-(SQRT(ABS(CLIFT(I))))+.7
IDEV=1
CALL LEZINI(IDEV)
NVALS=25
TITLE=' '
IAXLBL='[BLC]2Y/B'
DAXLBL='P[BLC]ROPERTIES FOR [FONT=9][BLC]A[FONT]=30[BSUP]O'
INDMIN=1.
INDMAX=1.
DEPMIN=0.
DEPMAX=0.
INDHV=1
LINAPP=1
CALL LEZLIN(SPAN,CLIFT,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+DEPMIN,DEPMAX,INDHV,LINAPP)
TITLE=' '
XPOS=7.0
YPOS=6.75
KENTRY='C[BSUB][BLC][FONT=11]L'
CALL LEZKEY(TITLE,XPOS,YPOS,KENTRY)
NVALS=25
IDTREL=1
LINAPP=1
KENTRY='C[BSUB][BLC]D'
CALL LEZDAT(CDRAG,NVALS,IDTREL,LINAPP,KENTRY)
NVALS=25
IDTREL=1
LINAPP=1
KENTRY='C[BSUB][BLC]M'
CALL LEZDAT(CMOMNT,NVALS,IDTREL,LINAPP,KENTRY)

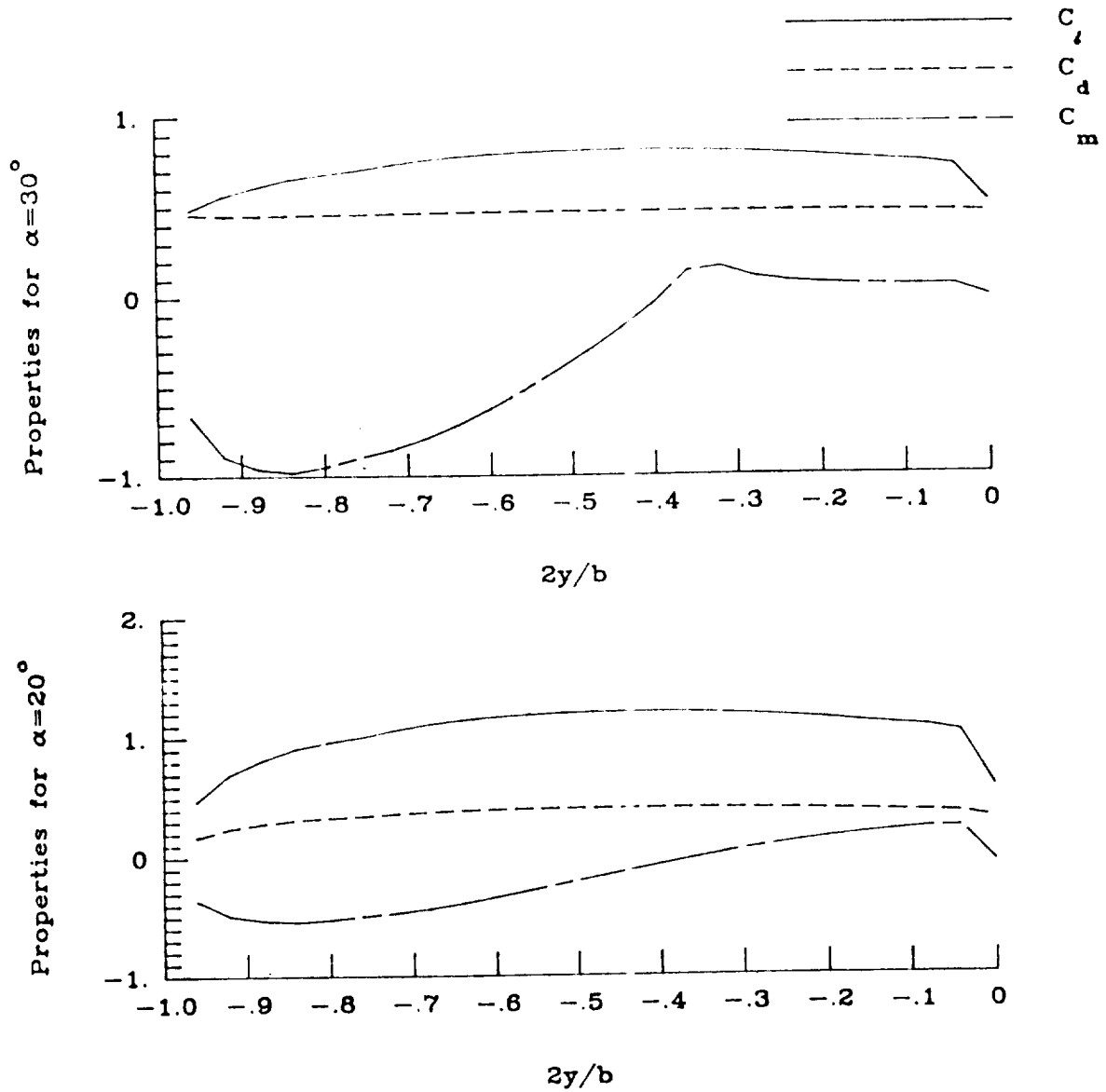
```



```

CALL LEZOPT('VAXLEN',2.)
CALL LEZOPT('YORIGIN',4.0)
CALL LEZNOT('DCMIX1',7.,0.,3,1,0)
CALL LEZSHW
CALL LEZTRM
STOP
END

```



Vortex flow about a 60° delta wing

DCMIX1

Figure 3-26. Example of a composite chart with multiple linear charts.

Notes.

3.6 Error Detection and Debugging Capabilities

This section describes the LEZ routines' error detection and processing capabilities, and the LEZ debugging mechanism designed to facilitate the user in implementing a chart.

A fundamental premise of the LEZ routines states that correct usage of the routines will generate a chart as described by this document. Correct usage consists of a proper sequence of calls with a proper set of routine arguments.

3.6.1 Error Detection

The error detection mechanism implemented in the LEZ routines is passive; that is as errors are detected, error messages are written to a specified destination. There is no means of error inquiry, nor any means of user-definable error recovery.

The errors detected by the LEZ routines are classified as non-fatal and fatal. Non-fatal errors are considered tolerable in that the LEZ routines can make suitable adjustments and continue processing. Fatal errors are those which are so severe that error recovery cannot occur, and the program terminates.

An example of a non-fatal error is the changing of an axis length to exceed the page length. An appropriate error message will be written indicating that the information cannot be used. Typically, errors due to invalid values will result in the arguments being set to their defaults. An example of a fatal error would be to call LEZSHW prior to calling the line, bar, or pie routines.

Figure 3-27 shows an example of the error detection and reporting features, along with the corresponding graphics output. Note, as shown by the following example, the default destination of the error messages is the output device (often overwriting the graphics output). Refer to section 3.6.3 for changing the destination of output.

The following program illustrates the LEZ error detection mechanism.

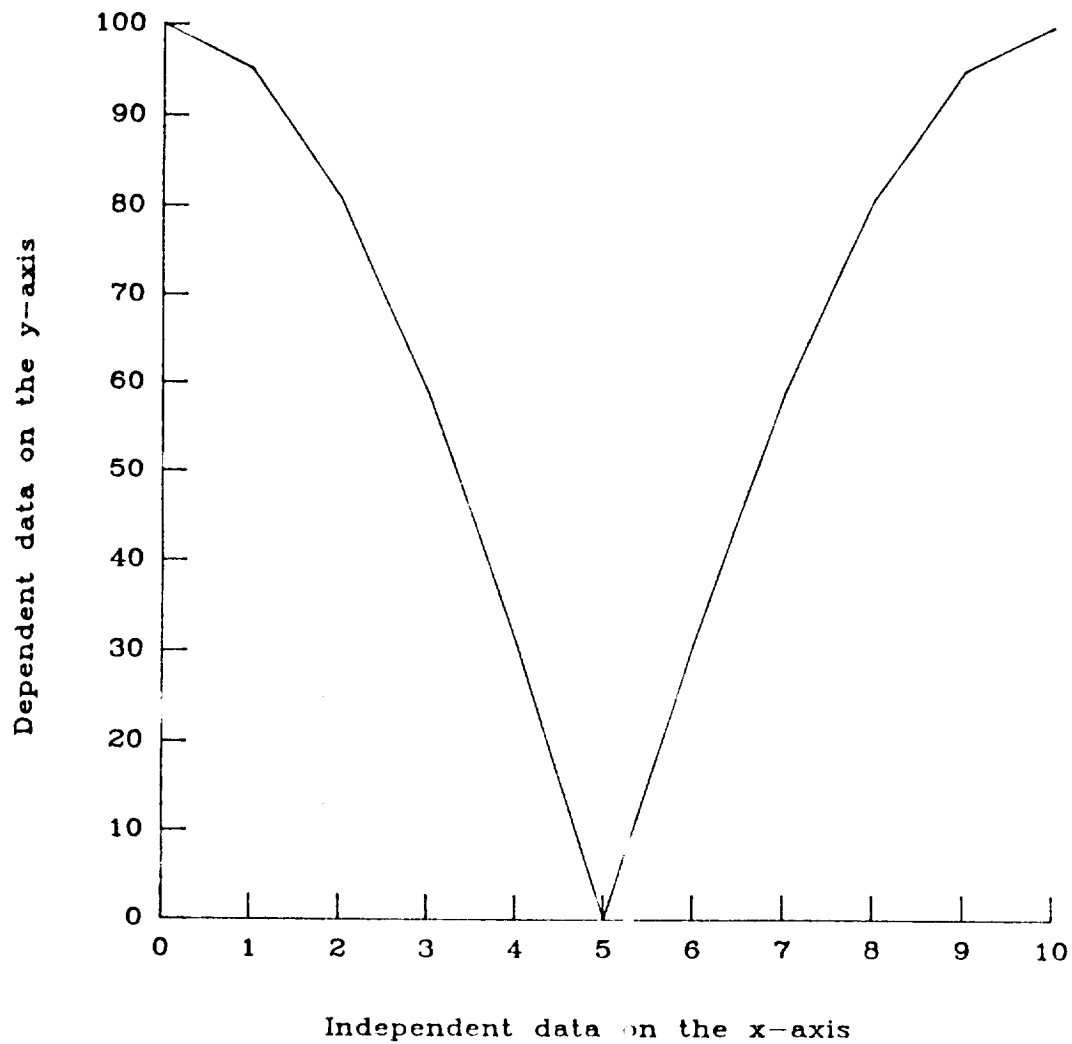
```

      PROGRAM DCDB1
C--- THE FOLLOWING PROGRAM IS A OPTIMIZED VERSION OF DCLINI.
C--- (SEE DCLINI FOR A COMMENTED VERSION OF THIS PROGRAM.)
C--- NOTE: A CALL TO LEZOPT HAS BEEN MADE TO GENERATE AN ERROR.
      REAL X(0:10),Y(0:10)
      CHARACTER TITLE*80
      DTRAD=ATAN(1.)/45.
      DO 10 I=0,10
          X(I)=REAL(I)
10      Y(I)=ABS(100.*COS(X(I)*18.*DTRAD))
      CALL LEZINI(1)
      TITLE=
+      'P[BLC]LOT OF Y=[FONT=24][ELC]B[FONT]100[BLC]COS18X'//
+      '[FONT=24][ELC]B'
      CALL LEZLIN(X,Y,11,TITLE,
+      'I[BLC]NDEPENDENT DATA ON THE X-AXIS',
+      'D[BLC]EPENDENT DATA ON THE Y-AXIS',
+      X(0),X(10),Y(5),Y(10),1,1)
      CALL LEZNOT('DCDB1',7.,0.,3,1,0)
C--- THE NEXT CALL WILL CAUSE AN ERROR MESSAGE TO BE GENERATED.
      CALL LEZOPT('HAXLEN',12.)
      CALL LEZSHW
      CALL LEZTRM
      STOP
      END

```

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 SECRETARY OF DEFENSE

LEZOPT: THE LENGTH OF THE HORIZONTAL AXIS EXCEEDS THE PAGE WIDTH.
THE ATTEMPTED HORIZONTAL LENGTH=12.
THE CURRENT X-ORIGIN IS 1.555555555556; THE CURRENT PAGE WIDTH IS 7.
THE CURRENT AXIS LENGTH OF 4.666666666667 WILL BE USED.



Plot of $y = |100\cos 18x|$

Figure 3-27. The LEZ error detection mechanism.

Notes.

3.6.2 Debugging Capabilities

The LEZ routine LEZDB provides a method for recording the calls to and the arguments of the LEZ routines. This enables the user to validate the sequence of LEZ calls, along with their arguments. There are two debug levels: 0 (OFF) or 1 (ON). Initially, the debug level is OFF (i.e. the default), but can be turned ON or OFF at any time. Thus, the user can control the amount and content of debugging output by setting the level to include or exclude sections of code to be monitored. To enable LEZ debugging, the user can enter

```
CALL LEZDB(1)
```

To disable LEZ debugging, the user can enter

```
CALL LEZDB(0)
```

When the debugging level is ON and a LEZ routine is entered, the following message(s) will be written:

```
routine name: ENTER
argument_1      : argument type  VALUE= value
argument_2(1)   : argument type  VALUE= value
argument_3(EQ)  : argument type  VALUE= value
```

where the lower-case strings will be replaced by actual values (see example on next page). Note, when an argument is an array, then a one in parentheses ("1") will follow the argument (see argument_2 above), and the first value of the array will be displayed. If an argument may vary in type depending on the context (e.g. INTEGER in one case, and REAL in another), then an "EQ" in parentheses ("EQ") will follow the argument (see argument_3 above), and the corresponding value of all applicable types will be displayed (see the following example).

Similarly, when the debugging level is ON and a LEZ routine is exited, the following message(s) will be written:

```
routine name: EXIT
```

where routine name will be replaced with an actual routine name (see example on next page). The above information validates the sequence of LEZ calls, along with the values and types of the corresponding arguments.

The following program illustrates the debugging capability along with some sample output.

```

      PROGRAM DCDB2
C--- THE FOLLOWING PROGRAM IS A OPTIMIZED VERSION OF DCLINI.
C--- (SEE DCLINI FOR A COMMENTED VERSION OF THIS PROGRAM.)
C--- NOTE: A CALL TO LEZOPT HAS BEEN MADE TO GENERATE AN ERROR.
C---      A CALL TO LEZDB HAS BEEN MADE.
      REAL X(0:10),Y(0:10)
      CHARACTER TITLE*80
      DTRAD=ATAN(1.)/45.
      DO 10 I=0,10
        X(I)=REAL(I)
10      Y(I)=ABS(100.*COS(X(I)*18.*DTRAD))
C--- SET LEZDB 'ON'. NOTE, BY DEFAULT MESSAGES ARE WRITTEN TO 'TAPE77'.
      CALL LEZDB(1)
      CALL LEZINI(1)
      TITLE=
+ 'P[BLC]LOT OF Y=[FONT=24][ELC]B[FONT]100[BLC]COS18X'//
+ '[FONT=24][ELC]B'
      CALL LEZLIN(X,Y,11,TITLE,
+ 'I[BLC]NDEPENDENT DATA ON THE X-AXIS',
+ 'D[BLC]EPENDENT DATA ON THE Y-AXIS',
+ X(0),X(10),Y(5),Y(10),1,1)
      CALL LEZNOT('DCDB2',7.,0.,3,1,0)
C--- THE NEXT CALL WILL CAUSE AN ERROR MESSAGE TO BE GENERATED.
      CALL LEZOPT('HAXLEN',12.)
      CALL LEZSHW
      CALL LEZTRM
      STOP
      END

```


The following output reflects the debug output written by default to TAPE77 (logical unit 77).

```

LEZDB: ENTER
  IDBLVL      : INTEGER  VALUE = 1
LEZDB: EXIT
LEZINI: ENTER
  IDEV        : INTEGER  VALUE = 1
LEZFIL: ENTER
  ICODE       : INTEGER  VALUE = 1
  LUN         : INTEGER  VALUE = 6
  CFILE       : CHAR*10  VALUE = OUTIUT
LEZFIL: EXIT
LEZINI: EXIT
LEZLIN: ENTER
  INDARY(1)   : REAL     VALUE = 0.
  DEPARY(1)   : REAL     VALUE = 100.
  NVALS       : INTEGER  VALUE = 11
  TITLE       : CHAR*(*) VALUE = P[BLC]LOT OF Y=[FONT=24][ELC]B[FONT]100
[BLC]COS18X[FONT=24][ELC]B
  IAXLBL      : CHAR*(*) VALUE = I[BLC]NDEPENDENT DATA ON THE X-AXIS
  DAXLBL      : CHAR*(*) VALUE = D[BLC]EPENDENT DATA ON THE Y-AXIS
  INDMIN      : REAL     VALUE = 0.
  INDMAX      : REAL     VALUE = 10.
  DEPMIN      : REAL     VALUE = 5.390302858158E-13
  DEPMAX      : REAL     VALUE = 100.
  INDHV       : INTEGER  VALUE = 1
  LINEA       : INTEGER  VALUE = 1
LEZLIN: EXIT
LEZNOT: ENTER
  STRING      : CHAR*(*) VALUE = DCD32
  XPOS        : REAL     VALUE = 7.
  YPOS        : REAL     VALUE = 0.
  IHJST       : INTEGER  VALUE = 3
  IVJST       : INTEGER  VALUE = 1
  IANG        : INTEGER  VALUE = 0
LEZNOT: EXIT
LEZOPT: ENTER
  OPTION      : INTEGER  VALUE = HAXLEN
  IVALS(1)    : INTEGER  VALUE = 275775108432265216
  IVALUE(EQ)  : INTEGER  VALUE = 275775108432265216
  RVALUE(EQ)  : REAL     VALUE = 12.
  LVALUE(EQ)  : LOGICAL  VALUE = F
LEZOPT: EXIT
LEZSHW: ENTER
LEZSHW: EXIT
LEZTRM: ENTER

```

Notes.

3.6.3 Destination of Output

The routine LEZFIL enables the user to control the output destination of error and debug processing. Error messages, both fatal and non-fatal, are written by default to output device (i.e. the current display device). This is often undesirable as it will overwrite graphics output. To redirect LEZ error messages the user can call

CALL LEZFIL(1,logical unit,filename).

The above call will inform the LEZ routines to redirect the subsequent LEZ error messages, indicated by the first argument, to the logical unit with the associated filename. If the file is not already open, LEZFIL will open the file with the appropriate filename and logical unit number as indicated.

Debug messages are written by default to the file TAPE77 associated with the logical unit 77. To redirect LEZ debug messages the user can call

CALL LEZFIL(2,logical unit,filename).

The above call will inform the LEZ routines to redirect the subsequent LEZ debug messages, indicated by the first argument, to the logical unit with the associated filename. If the file is not already open, LEZFIL will open the file with the appropriate filename and logical unit number as indicated.

It is often advantageous to redirect output from several processes into a single output destination. This will provide the user with a single collection of information in the order in which the appropriate processes were executed.

The following program illustrates the changing of the error and debugging destination.

```

      PROGRAM DCDB3
C--- THE FOLLOWING PROGRAM IS A OPTIMIZED VERSION OF DCLINI.
C--- (SEE DCLINI FOR A COMMENTED VERSION OF THIS PROGRAM.)
C--- NOTE: A CALL TO LEZOPT HAS BEEN MADE TO GENERATE AN ERROR.
C---      A CALL TO LEZDB HAS BEEN MADE.
      REAL X(0:10),Y(0:10)
      CHARACTER TITLE*80
      DTRAD=ATAN(1.)/45.
      DO 10 I=0,10
        X(I)=REAL(I)
10      Y(I)=ABS(100.*COS(X(I)*18.*DTRAD))
C--- WRITE CGL ERROR MESSAGES TO UNIT 80, FILE 'TAPE80'
      CALL LEZFIL(1,80,'TAPE80')
C--- WRITE CGL DEBUG MESSAGES TO UNIT 80, FILE 'TAPE80'
      CALL LEZFIL(2,80,'TAPE80')
C--- SET LEZDB 'ON'. NOTE, BY DEFAULT MESSAGES ARE WRITTEN TO 'TAPE77'.
      CALL LEZDB(1)
      CALL LEZINI(1)
      TITLE=
      + 'P[BLC]LOT OF Y=[FONT=24][ELC]B[FONT]100[BLC]COS18X'//
      + '[FONT=24][ELC]B'
      CALL LEZLIN(X,Y,11,TITLE,
      + 'I[BLC]NDEPENDENT DATA ON THE X-AXIS',
      + 'D[BLC]EPENDENT DATA ON THE Y-AXIS',
      + X(0),X(10),Y(5),Y(10),1,1)
      CALL LEZNOT('DCDB3',7.,0.,3,1,0)
C--- THE NEXT CALL WILL CAUSE AN ERROR MESSAGE TO BE GENERATED.
      CALL LEZOPT('HAXLEN',12.)
      CALL LEZSHW
      CALL LEZTRM
      STOP
      END

```

Note, this example redirects both error and debugging messages and combines them on the same file for ease of debugging. The user could also write to the same unit, possibly delimiting sections of this file to examine carefully.

```

LEZDB: ENTER
  IDBLVL      : INTEGER  VALUE = 1
LEZDB: EXIT
LEZINI: ENTER
  IDEV        : INTEGER  VALUE = 1
LEZINI: EXIT
LEZLIN: ENTER
  INDARY(1)   : REAL     VALUE = 0.
  DEPARY(1)   : REAL     VALUE = 100.
  NVALS       : INTEGER  VALUE = 11
  TITLE       : CHAR*(*) VALUE = P[BLC]LOT OF Y=[FONT=24][ELC]B[FONT]100
[BLC]COS18X[FONT=24][ELC]B
  IAXLBL      : CHAR*(*) VALUE = I[BLC]NDEPENDENT DATA ON THE X-AXIS
  DAXLBL      : CHAR*(*) VALUE = D[BLC]EPENDENT DATA ON THE Y-AXIS
  INDMIN      : REAL     VALUE = 0.
  INDMAX      : REAL     VALUE = 10.
  DEPMIN      : REAL     VALUE = 5.390302858158E-13
  DEPMAX      : REAL     VALUE = 100.
  INDHV       : INTEGER  VALUE = 1
  LINEA       : INTEGER  VALUE = 1
LEZLIN: EXIT
LEZNOT: ENTER
  STRING      : CHAR*(*) VALUE = DCDB3
  XPOS        : REAL     VALUE = 7.
  YPOS        : REAL     VALUE = 0.
  IHJST       : INTEGER  VALUE = 3
  IVJST       : INTEGER  VALUE = 1
  IANG        : INTEGER  VALUE = 0
LEZNOT: EXIT
LEZOPT: ENTER
  OPTION      : INTEGER  VALUE = HAXLEN
  IVALS(1)    : INTEGER  VALUE = 275775108432265216
  IVALUE(EQ)  : INTEGER  VALUE = 275775108432265216
  RVALUE(EQ)  : REAL     VALUE = 12.
  LVALUE(EQ)  : LOGICAL  VALUE = F
LEZOPT: INVALID VALUE FOR OPTION "HAXLEN".
          THE LENGTH OF THE HORIZONTAL AXIS  EXCEEDS THE PAGE WIDTH.
          THE ATTEMPTED HORIZONTAL LENGTH = 12.
          THE CURRENT X-ORIGIN IS 1.555555555556; THE CURRENT PAGE WIDTH IS 7.
          THE CURRENT AXIS LENGTH OF 4.666666666667 WILL BE USED.
LEZOPT: EXIT
LEZSHW: ENTER
LEZSHW: EXIT
LEZTRM: ENTER

```

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Notes.

4. Postprocessing Considerations

This section gives basic information needed to postprocess plots generated by the LEZ routines. This section also describes what postprocessing capabilities are available, and what information is necessary in order to interface with the postprocessors.

Most large-scale, general-purpose graphics packages provide the ability to generate and manipulate graphical information in an external file. Thus the user can generate interactive plots, and save the equivalent graphical representation on a file for later use. However, the ability to postprocess depends on a translator to convert the external file information into appropriate instructions to drive the physical device. Thus, the translator can take the same external file and plot (or display) it on several different display devices.

4.1 Distortion and Scaling

If the user requests, the LEZINI routine will flag the CGL to generate a metafile. In order to postprocess this metafile, the user should know the dimensions used to draw the image. The user is responsible for requesting the appropriate dimensions of the plotter, typically by matching the metafile's aspect ratio. All of the plotters regard a metafile's aspect ratio as its height to width (determined by the viewspace). Proper information will ensure:

- a compatible aspect ratio between the page size and the device coordinate system. For example, a plot generated in a 7- by 7-inch page size should be plotted in an area of equal dimensions or square aspect ratio to avoid distortion.
- the scaling to be performed from the world coordinate to device is consistent (e.g., a 7- by 7-inch plot is sent to a plotting device and will be plotted on a 7- by 7-inch region).

The default page size is 7 by 7, which has a square aspect ratio. The user may alter this aspect ratio by the use of LEZPGE; however, the user must ensure a compatible postprocessor aspect ratio when postprocessing the plot. The NGS software defaults to plot in the largest possible square on a given device. This ratio may be changed to meet specific needs. Since each plotter uses a different frame size, the physical dimensions of the square varies between devices.

The COMMON GRAPHICS LIBRARY offers routines which support commonly used aspect ratios, such as page size, and also allows the user the capability of setting an aspect ratio to meet specific requirements.

Currently, the LEZ routines establish a default world coordinate system of 7- by 7-units (e.g., inches). This implies the aspect ratio is 1. To avoid distortion, the user should select a plotter aspect ratio of 1. For example:

```
PLOT.CAL,11(HEIGHT=7.,WIDTH=7.)  
or  
PLOT.CAL,11(HEIGHT=11.,WIDTH=11.)
```

The first plot instruction will plot the image on the CalComp 11" plotter in an 7- by 7-inch region (matching identically with the image area). The second plot instruction will plot the image in an 11- by 11-inch region (proportionally enlarging all objects).

4.2 Visual Characteristics

Because of the variations in plotter characteristics, the user should try to use only enough colors to specifically address the needs of the plots. If monochrome copies are to be made, then line patterns and fill patterns should be clear enough so that the contents of the chart are distinguished easily by the reader. Care should also be taken to ensure that text is properly positioned on the page and is of sufficient size that it is legible. The text should be **bold** enough so that it may be copied by a photocopy device without losing any portion of a character. Viewgraphs should contain characters large and bold enough to be seen across a dark room. All of these items require planning in the design of a plot. Fortunately for the user, there are usually consistent requirements. Once the appropriate technique is selected, most plots will conform to standards, thus resulting in little or no change to the user's plot program.

4.3 DI-3000 Concepts as Related to Static Plotters

The LEZ routines use DI-3000 as its underlying graphics package, and thus generates external files, called metafiles, which can be postprocessed using the Metafile Translator. Thus, DI-3000 provides a device independent method of generating plots which can be displayed on several different devices (interactive or hardcopy) without the need of major code modifications.

However, certain postprocessing limitations are present and need to be addressed. First, the availability of the devices is installation dependent, and the supported device drivers may further restrict this accessibility. Second, each device has inherent limitations (such as color, selective erase, and so forth), and these device dependent characteristics can have a major impact on the resultant output. Most notably, special considerations are needed to ensure that proper sizing or scaling is consistent between the constructed image and the plotted image. Specific information for devices are given in the device driver manuals [G-10].

The plotters vary in the quality and types of plots that are generated. The pen plotter provides smooth lines but limits the available colors. The pen plotter will also allow for varying the thickness of a line. The electrostatic plotters offer limited line thickness and also may not generate smooth curves because of the pixel resolution. This non-smooth problem is usually eliminated by generating larger plots and then having them reduced.

4.4 Postprocessors

The postprocessor is a separate program that reads a metafile, performs various operations on the file, and formats the data to a file that can be used to drive the specified graphics plotting device.

The Metafile Translator is a plot postprocessor which is useful for previewing and editing of metafiles. The Metafile Translator is documented in the Metafile User's Guide [G-6]. The Metafile Translator instructions allow more flexibility in how the metafile may be displayed.

A special form of the Metafile Translator is the PLOT control statement which is available on the ACD central computers (CDC/NOS). The PLOT statement is documented in the ACD static plotter device driver manual [G-10].

Notes.

APPENDIX A

DESCRIPTION OF THE LEZ ROUTINES

The LEZ routines are described in detail on the following pages. The following information is provided for each routine:

- Subroutine Name:** The subroutines are listed in alphabetical order. The name of the routine appears at the top of the page on which the routine appears.
- Purpose:** A brief description of what the routine is used for.
- Use:** The structure of how to call the routine. Also a list of the parameters for that routine with a description of what they are and the types of values they accept.
- Restrictions:** A list of restrictions on the values passed to the parameters or on the use of that routine.
- Notes:** Any further information that the user might have need to know.

Description of the LEZ Routines

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LEZAXN - Specify Numeric Tick Mark Labels For An Axis

LANGUAGE: FORTRAN 77

PURPOSE: To override the default tick mark labels, and
 specify numeric tick mark labels for an axis.

This routine allows the user to change the axis tick mark appearance with numeric tick marks (i.e. the number of decimal places, the number of major tick marks and their values, and the number of minor tick marks).

This routine only changes the axis tick marks, it does not change the corresponding data space. The user is therefore advised to maintain consistency between the data space and corresponding axis tick mark values.

USE: CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

where: IHV - An indicator of whether this call applies to the horizontal or vertical axis.
 IHV = 1---->horizontal
 IHV = 2---->vertical
 type:INTEGER

 NDEC - Number of digits to the right of the decimal point in the tick mark labels of the axis.
 > 0 - Number of digits to the right of the decimal point.
 = 0 - Decimal point only.
 < 0 - Display as integer (i.e. no decimal point).

 TSTART - The data value at which the first major tick mark is to be placed.
 type:REAL

 TINCR - The increment in data units between major tick marks.
 type:REAL

 TEND - The last data value at which a major tick mark is to be placed.
 type:REAL

 NTMINR - The number of minor tick marks to be placed between each major tick mark (NTMINR >= 0).
 type:INTEGER

RESTRICTIONS: This routine must be called after LEZLIN, LEZBAR, or LEZLBR. TSTART cannot equal TEND. TSTART can be less than TEND to produce a decreasing axis. However, TINCR must then be negative (e.g. from 10.0 to -10.0 by increments of -2.0).

ERRORS:

LEZAXN: IHV OUT OF RANGE--MUST BE 1 OR 2.
CALL TO LEZAXN IGNORED.

LEZAXN: TSTART CANNOT EQUAL TEND.
CALL TO LEZAXN IGNORED.

LEZAXN: DECREASING AXIS MUST HAVE A NEGATIVE "TINCR".
TSTART = tstart
TEND = tend
TINCR = tincr
CALL TO LEZAXN IGNORED.

LEZAXN: TOO MANY MAJOR TICK MARKS REQUESTED.
LIMIT = maxlab
CHECK ESTART, TEND, AND TINCR.
TSTART = tstart
TEND = tend
TINCR = tincr
ICOUNT = icount
CALL TO LEZAXN IGNORED.

LEZAXN: INVALID VALUE FOR NTMINR. NTMINR= ntminr
VALID RANGE IS INTEGER 0 OR GREATER
CALL TO LEZAXN IGNORED.

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LEZAXS - Override Numeric Tick Mark Labels With Scientific Labels

LANGUAGE: FORTRAN 77

PURPOSE: To override the default numeric tick mark labels for an axis with scientific tick mark labels.

This routine allows the user to change the axis tick mark appearance with scientific tick marks (i.e. the number of major tick marks and their values, and the the number of minor tick marks).

This routine only changes the axis tick marks, it does not change the corresponding data space. The user is therefore advised to maintain consistency between the data space and corresponding axis tick mark values.

Note, the number of major tick marks is determined by $\text{IABS}(\text{NINT}((\text{TEND}-\text{TSTART})/\text{TINCR}))+1$. The number of decimal places to the right of the decimal point for each major tick mark is determined by $\text{NINT}(\text{LOG10}(\text{ABS}(\text{TSTART})))$. Note: this must be further refined..

USE: CALL LEZAXS(IHV,TSTART,TINCR,TEND,IEXP,NTMINR)

where: IHV - An indicator of whether this call applies to the horizontal or vertical axis.
 IHV = 1---->horizontal
 IHV = 2---->vertical
 type: INTEGER

 TSTART - The beginning axis tick mark label.
 type: REAL

 TINCR - The axis tick mark increment.
 type: REAL

 TEND - The ending axis tick mark label.
 type: REAL

 IEXP - The power of 10 the labels are to be raised to.
 type: INTEGER

 NTMINR - The number of minor tick marks to be placed between each major tick mark. (NTMINR >= 0)
 type: INTEGER

RESTRICTIONS: This routine must be called after LEZLIN, LEZLOG, or

LEZLBR. (THIS doesn't work for the axis from
which the bars originate for LEZBAR.)
ERRORS:

LEZAXS: IHV OUT OF RANGE--MUST BE 1 OR 2.
CALL TO LEZAXS IGNORED.

LEZAXS: TSTART CANNOT EQUAL TEND.
CALL TO LEZAXS IGNORED.

LEZAXS: DECREASING AXIS MUST HAVE A NEGATIVE "TINCR".
TSTART = tstart
TEND = tend
TINCR = tincr
CALL TO LEZAXS IGNORED.

LEZAXS: TOO MANY MAJOR TICK MARKS REQUESTED.
LIMIT = maxlab
CHECK TSTART, TEND, AND TINCR.
TSTART = tstart
TEND = tend
TINCR = tincr
ICOUNT = icount
CALL TO LEZAXS IGNORED.

LEZAXS: INVALID VALUE FOR NTMINR. NTMINR= ntminr
VALID RANGE IS INTEGER 0 OR GREATER
CALL TO LEZAXS IGNORED.

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LEZAXT - Override Numeric Tick Mark Labels With Text
Tick Mark Labels

LANGUAGE: FORTRAN 77

PURPOSE: To override the default numeric tick mark labels for
 an axis with text tick mark labels.

This routine allows the user to change the axis tick
mark appearance with character tick marks (i.e. the
number of major tick marks and their values, and the
the number of minor tick marks).

This routine only changes the axis tick marks,
it does not change the corresponding data space.
The user is therefore advised to maintain consistency
between the data space and corresponding axis tick
mark values.

Note, NLABS does not have to equal NTMAJR (i.e. the
number of major tick marks and the number of labels).
The number of major tick marks will be NTMAJR, but
the corresponding labels may vary.

If NLABS is less than NTMAJR, then only the first
NLABS major tick marks will be labelled (the rest
will be blank filled).

If NLABS is greater than NTMAJR, then only the first
NLABS major tick marks will be labelled.

USE: CALL LEZAXT(IHV,NLABS,LABELS,NTMAJR,NTMINR)

where: IHV - An indicator of whether this call
 applies to the horizontal or vertical
 axis.
 IHV = 1---->horizontal
 IHV = 2---->vertical
 type: INTEGER

NLABS - The number of tick mark labels
 contained in the string LABELS.
 type: INTEGER

LABELS - A DI-3000 text string with NLABS
 labels, each label ending with
 a '\$' delimiter, containing text
 labels for the axis designated by IHV
 Example: ('\$-4\$-2\$0\$2\$4\$') The
 beginning '\$' is optional but the
 ending '\$' is required.
 type: CHARACTER

NTMAJR - The number of major tick marks to be placed on the axis (end tick marks inclusive). (NTMAJR >= 2)
type: INTEGER

NTMINR - The number of minor tick marks to be placed between each major tick mark. (NTMINR >= 0)
type: INTEGER

RESTRICTIONS: This routine must be called after LEZLIN, LEZBAR, or LEZLBR.

ERRORS:

LEZAXT: INVALID VALUE FOR NLABS. NLABS = nlabs
VALID RANGE IS INTEGER FROM 1 TO maxlab
ROUTINE IGNORED.

LEZAXT: INVALID VALUE FOR NTMAJR. NTMAJR = ntmajr
VALID RANGE IS INTEGER 2 OR GREATER.
ROUTINE IGNORED.

LEZAXT: INVALID VALUE FOR NTMINR. NTMINR = ntminr
VALID RANGE IS INTEGER 0 OR GREATER.
ROUTINE IGNORED.

LEZAXT: INVALID VALUE FOR IHV. IHV = ihv
VALID RANGE IS INTEGER 1 OR 2.
ROUTINE IGNORED.

LEZBAR - Establish The Chart As A Bar Graph

LANGUAGE: FORTRAN 77

PURPOSE: To establish the chart as a bar graph such that the data and tick marks are placed at exact locations on the axis (not evenly spaced).

USE: CALL LEZBAR(INDARY,DEPARY,NVALS,TITLE,IAXLBL,DAXLBL,
 INDMIN,INDMAX,DEPMIN,DEPMAX,INDHV,IBRAPP)

Where: INDARY - The bar chart independent
 variable data set.
 type:REAL

DEPARY - The bar chart dependent variable data
 set.
 type:REAL

NVALS - The number of values in INDARY
 and DEPARY. There will be
 NVALS bars.
 type:INTEGER

TITLE - used as the title line in the chart.
 type:CHARACTER

IAXLBL,
DAXLBL - DI-3000 text strings to be
 used as the independent and
 dependent axis labels, respectively.
 type:CHARACTER

INDMIN,
INDMAX - The minimum and maximum values
 for the independent variable axis.
 type:REAL

DEPMIN,
DEPMAX - The minimum and maximum values
 for the dependent variable axis.
 type:REAL

INDHV - An indicator of whether the
 independent variable should be
 placed on the horizontal or the
 vertical axis.
 INDHV = 1---->HORIZONTAL
 INDHV = 2---->VERTICAL.
 type:INTEGER

IBRAPP - An indicator of whether all

bars in the chart should be
filled or unfilled.
IBRAPP = 0---->UNFILLED
IBRAPP = 1---->FILLED.
type:INTEGER

RESTRICTIONS: None.

ERRORS:

LEZBAR: NVALS EXCEEDS LIMIT OF MAXIMUM TICK MARKS
PROGRAM TERMINATED.

LEZBAR: NVALS MUST BE 1 OR GREATER (INTEGER).
PROGRAM TERMINATED.

LEZBAR: INDHV OUT OF RANGE--MUST BE 1 OR 2.
PROGRAM TERMINATED.

LEZBAR: IBRAPP OUT OF RANGE; SHOULD = 0 OR 1.
PROGRAM TERMINATED.

NOTES:

The bars are plotted in LEZSHW.

The title of the plot is placed according to
publication standards at the bottom of the page.

By default, tick marks are not drawn on the
independent axis, and are drawn to the left on the
dependent axis. To override this default tick mark
positioning, call LEZOPT with options HTICPOS and
VTICPOS after this routine.

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LEZDAT - Add Dependent Data Set To A Bar Chart Or Line Chart

LANGUAGE: FORTRAN 77

PURPOSE: To add dependent data sets to a bar chart or line chart.

USE: CALL LEZDAT(DEPARY,NVALS,IDTREL,IDTAPP,KENTRY)

where: DEPARY - an additional line or bar
graph dependent variable data set.
type: REAL

NVALS - the number of values in the
array DEPARY.
type: INTEGER

IDTREL - an indicator of the relationship
among the dependent data sets to
be displayed in the current chart.
IDTRE = 1---->absolute
IDTRE = 2---->additive (not implemented
for LEZLIN and LEZLOG)
type: INTEGER

IDTAPP - for line graphs, a line appearance
indicator for the curve to be drawn.
IDTAPP = 1---->line
IDTAPP = 2---->marker
IDTAPP = 3---->line and marker
type: INTEGER

For bar graphs, an indicator of
whether all bars in the chart
should be filled or unfilled.
IDTAPP = 0---->unfilled
IDTAPP = 1---->filled
type: INTEGER

KENTRY - The key entry to be associated
with the dependent data set. If no
key is to be displayed, this
parameter must be passed as a null
string(i.e. ' ').
type: CHARACTER

RESTRICTIONS: If NVALS is greater than or equal to the number of
values in the first dependent data set defined for the
chart, only the originally specified number of data
values will be used. If NVALS is less than the
originally specified number of values, only NVALS
values will be used.

ERRORS:

- LEZDAT: IDTREL OUT OF RANGE; SHOULD EQUAL A 1 OR 2.
DATA SET IGNORED.
- LEZDAT: THE NUMBER DATA SETS EXCEEDS THE LIMIT.
MAXIMUM FOR LEZLIN = maximum data sets
DATA SET IGNORED.
- LEZDAT: THE NUMBER OF VALUES OF DATA SET `barct+1`
EXCEEDS THE MAXIMUM SET BY "LEZLIN".
MAXIMUM FOR LEZLIN = maximum points
CURRENT FOR LEZDAT = nvals
DATA SET IGNORED.
- LEZDAT: THE NUMBER OF BAR DATA VALUES HAS EXCEEDED LIMIT
ON DATA SET # `barct+1`
DATA SET IGNORED.
- LEZDAT: THE NUMBER OF VALUES OF DATA SET `barct+1`
EXCEEDS THE MAXIMUM SET BY "LEZBAR".
MAXIMUM FOR LEZBAR = `ntic`
CURRENT FOR LEZDAT = `nvals`
DATA SET IGNORED.
- LEZDAT: LEZDAT CANNOT BE CALLED WITH A PIE CHART.
CALL TO LEZDAT IGNORED.
- LEZDAT: THE CHART TYPE IS UNDEFINED.
CALL LEZBAR, LEZLBR, OR LEZLIN FIRST.
PROGRAM TERMINATED.
- LEZDAT: IDTAPP OUT OF RANGE FOR LINES SHOULD = 0, 1, 2, OR 3.
CALL TO LEZDAT IGNORED.
- LEZDAT: IDTAPP OUT OF RANGE FOR BARS SHOULD = 0 OR 1.
CALL TO LEZDAT IGNORED.

LEZDB - Change The LEZ Debug Level.

LANGUAGE: FORTRAN 77

PURPOSE: Change the LEZ debug level.

USE: CALL LEZDB(IDBLVL)

WHERE: IDBLVL - The debug level.

0 - Debugging turned OFF. (default)

1 - Debugging turned ON.

type INTEGER

ERRORS:

LEZDB: INVALID ARGUMENT IN LEZDB.

IDBLVL SHOULD BE AN INTEGER 0 OR 1.

IDBLVL NOT CHANGED, CURRENT VALUE = idblvl

NOTES:

. See LEZFIL for the file name and associated logical unit where the debugging information is written.

LEZFIL - Change The Output Destination Of Various Processes.

LANGUAGE: FORTRAN 77

PURPOSE: Change the output destination of various processes.
This routine opens a file, denoted by the logical unit
LUN and file name of CFILE.

USE: CALL LEZFIL(ICODE,LUN,CFILE)

WHERE: ICODE - Specifies the process to be changed.
 1 - Error processing.
 2 - Debug processing.
 3 - Internal processing (LEZLIN/LEZLOG).
 type: INTEGER

 LUN - Output logical unit.
 Must be an integer greater than 0.
 Logical units are MACHINE DEPENDENT.
 type: INTEGER

 CFILE - Output file descriptor.
 CFILE declared internally as size of 7.
 Valid file names are MACHINE DEPENDENT.
 type: CHARACTER

ERRORS:

LEZFIL: INVALID ARGUMENT IN LEZFIL.
 ICODE MUST BE AN INTEGER 1,2, OR 3.
 NO CHANGE HAS BEEN MADE.

LEZFIL: INVALID ARGUMENT IN LEZFIL.
 LUN SHOULD BE AN INTEGER GREATER THAN 0.
 NO CHANGE HAS BEEN MADE.

LEZFIL: INVALID ARGUMENT IN LEZFIL.
 CFILE IS INVALID.
 NO CHANGE HAS BEEN MADE.

LEZFIL: LUN=lun WAS ASSIGNED TO "fn".
 REASSIGNED TO "jfile".

LEZFIL: ERROR DURING OPEN.
 ICODE,LUN,CFILE= icode,lun,"cfile".
 FILE NOT PROCESSED.

LEZFIL: ERROR DURING INQUIRE.
 ICODE,LUN,CFILE= icode,lun,"cfile".
 FILE NOT PROCESSED.

NOTES: The files are opened with:

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"OPEN(UNIT=LUN,FILE=CFILE,STATUS=UNKNOWN").
All other file attributes use MACHINE defaults.

Both LUN and CFILE must be valid before files are
processed.

LEZGET - Get Values Of LEZOPT And Other LEZ Related Attributes.

LANGUAGE: FORTRAN 77

PURPOSE: Get Values Of LEZOPT And Other LEZ Related Attributes.

USE: CALL LEZGET(OPTION,IVALS,NVALS,MVALS)

WHERE : OPTION - A variable to designate which parameter
 is to be changed in the options list.

BFILLD ---> Whether to fill pies, bars, or
 "between" lines.
CLEAR ---> If LEZSHW is to clear the screen
 after display
COLOR ---> Interior color (pies, bars, lines)
DASH ---> Dashed lines from major tick marks
 perpendicular to the dependent axis
HAXLEN ---> Change length of horizontal axis
HTICPOS ---> Change tick mark position in
 relation to the horizontal axis.
HTLABR ---> Rotate text on horizontal axis
INTPAT ---> Interior pattern (pies, bars, lines)
KEYJUST ---> Select the justification point for
 location of key
LINPAT ---> Line pattern for line plots
PAUSE ---> If LEZSHW is to pause after display
RADIUS ---> Change radius of pie
RTAXIS ---> Draw second vertical axis
SYMNUM ---> Symbol number (for line plots)
SYMSIZ ---> Symbol size (for line plots)
VAXLEN ---> Change length of vertical axis
VERSION ---> The current version of CGL routines
VLABDR ---> Set justification of vertical
 axis label
VTLABR ---> Rotate text on the vertical axis
VTICPOS ---> Change tick mark position in
 relation to the vertical axis.
XORIGIN ---> Change x coordinate of origin
YORIGIN ---> Change y coordinate of origin
type: CHARACTER

IVALS - The returned value(s) for the option
 controlled by OPTION:

NVALS - The maximum number of values returned.

MVALS - The maximum number of values returned.

Detailed description of each specific option

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NOTE: all the options in LEZOPT are accessible here. Please refer to LEZOPT for a complete description of these options and their corresponding base type (i.e. INTERGER, REAL, arrayed, unarrayed, etc.).

The following OPTIONS are those in addition to the ones given in LEZOPT.

OPTION	DESCRIPTION
VERSION	The version number of the current CGL routines. type: INTEGER

RESTRICTION:

ERRORS:

LEZIND - To Redefine The Independent Array For A Curve

LANGUAGE: FORTRAN 77

PURPOSE: To redefine the independent array for a curve.

USE: CALL LEZIND(INDARY,NVALS)

WHERE: INDARY - An additional independent data set.
 type:REAL

 NVALS - The number of values in the array.
 type:REAL

RESTRICTIONS: LEZIND must be called before LEZDAT,
 LEZLIN must be called prior to a call to LEZIND,
 and the dimensions (MIN:MAX) defined in LEZLIN must
 be able to include any additional data defined
 in LEZIND and LEZDAT. NVALS in LEZIND must equal
 NVALS in LEZDAT.

ERRORS:

LEZIND: NUMBER OF DATA SETS LIMITED TO maximum data sets
DATA SET IGNORED.

LEZIND: NEGATIVE DATA OR ZERO ON LOG AXIS
PROGRAM TERMINATED.

LEZINI - Initialize The Underlying DI-3000 and CGL Subroutines

LANGUAGE FORTRAN 77

PURPOSE: To initialize the CGL routines and attributes, and
 the underlying graphics package (and attributes).

This routine can be called more than once. This routine will reset the majority of LEZ attributes, and plot characteristics back to their initial defaults. Some LEZ variables are considered "global" (i.e. not affected by calls to LEZINI):

- page height and width;
- debug and error levels/files

USE: CALL LEZINI(IDEV)

WHERE: IDEV - A DI-3000 logical device
 0 metafile
 1 screen
 2 both
 type: INTEGER

RESTRICTION: Default Page Size = 7.0 x 7.0 (Page Coordinates).

ERRORS:

LEZINI: INVALID LOGICAL DEVICE NUMBER (IDEV) OF idev
 PROGRAM TERMINATED.

LEZKEY - To Initiate The Creation Of A Key For The Chart

LANGUAGE: FORTRAN 77

PURPOSE: To initiate the creation of a key
 for the current chart.

USE: CALL LEZKEY (TITLE,XPOS,YPOS,KENTRY)

WHERE: TITLE - Title of the chart key.
 type: CHARACTER

 XPOS,
 YPOS - Location on the page at which to
 position the justification point of
 the key.
 type: REAL

 KENTRY - The key entry to be associated with
 the data set.
 type: CHARACTER

RESTRICTIONS: Only one key entry per chart. XPOS and YPOS are
 limited to the dimensions of your page(see LEZINI).

ERRORS:

LEZKEY: (XPOS,YPOS)=(xpos,ypos) NOT ON PAGE
CALL TO LEZKEY IGNORED.

NOTES:

The key can be put anywhere on the page. The
default justification of the key box is the
upper right corner. The size of the key may
be reduced to fit into an area denoted by XPOS, YPOS,
and the page boundary.

LEZLBR - Establish the Chart as a Bar Graph with Text Labels

LANGUAGE: FORTRAN 77

PURPOSE: To establish the chart as a bar graph with evenly spaced bars, and text labels on the independent axis.

USE: CALL LEZLBR(VALUE\$, NVALS , TITLE , LABELS , IAXLBL ,
 DAXLBL , VALMIN , VALMAX , INDHV , I\$RAPP)

WHERE: VALUE\$ - The bar graph dependent variable data set.

 Type: REAL

 NVALS - The number of values in VALUE\$.

 Type: INTEGER

 TITLE - A DI-3000 text string to be used as the title line in the graph.

 Type: CHARACTER

 LABELS - A DI-3000 text string with NVALS labels, each label ending with a '\$' delimiter, containing all text labels for the axis tick mark labels designated by INDHV. Example: ('\$-2\$0\$2\$') The beginning '\$' is optional but the ending '\$' is required.

 Type: CHARACTER

 IAXLBL ,

 DAXLBL - DI-3000 text strings to be used as the independent and dependent axis labels respectively.

 Type: CHARACTER

 VALMIN ,

 VALMAX - The minimum and maximum values for the dependent variable axis.

 Type: REAL

 INDHV - An indicator of whether the independent variable should be placed on the horizontal or vertical axis.

 INDHV = 1 ----->horizontal

 INDHV = 2 ----->vertical

 type: INTEGER

 I\$RAPP - An indicator of whether all bars in the chart should be filled or

unfilled.
IBRAPP = 0 ----->unfilled
IBRAPP = 1 ----->filled
type:INTEGER

RESTRICTIONS: None

ERRORS:

LEZLBR: NVALS EXCEEDS LIMIT OF maximum tick marks
PROGRAM TERMINATED.

LEZLBR: INDHV OUT OF RANGE--MUST BE 1 OR 2.
PROGRAM TERMINATED.

LEZLBR: IBRAPP OUT OF RANGE; SHOULD = 0 OR 1.
PROGRAM TERMINATED.

NOTES: The title of the chart is placed according to
publication standards at the bottom of the page.

By default, tick marks are not drawn on the
independent axis, and are drawn to the left on the
dependent axis. To override this default tick mark
positioning, call LEZOPT with options HTICPOS and
VTICPOS after this routine.

LEZLIN - Establish The Chart As A Linear Graph

LANGUAGE: FORTRAN 77

PURPOSE: To establish the chart as a linear graph.

USE: CALL LEZLIN(INDARY,DEPARY,NVALS,TITLE,IAXLBL,DAXLBL,
 INDMIN,INDMAX,DEPMIN,DEPMAX,INDHV,LINAPP)

WHERE: INDARY - The line chart independent variable
 data set.

 type: REAL

DEPARY - The line chart dependent variable
 data set.

 type: REAL

NVALS - The number of values in INDARY
 and DEPARY.

 type: INTEGER

TITLE - A DI-3000 text string to be used
 as the title line in the chart.

 type: CHARACTER

IAXLBL,

DAXLBL - DI-3000 text string to be used as
 the independent and dependent axis
 labels, respectively.

 type: CHARACTER

INDMIN,

INDMAX - The minimum and maximum values for
 the independent variable axis.

 type: REAL

DEPMIN,

DEPMAX - The minimum and maximum values for
 the dependent variable axis.

 type: REAL

INDHV - An indicator of whether the
 independent variable should be
 placed on the horizontal or the
 vertical axis.

 INDHV = 1 --->horizontal

 INDHV = 2 --->vertical

 type: INTEGER

LINAPP - A line appearance indicator for the
 curve to be drawn.

```
LINAPP = 1---->line  
LINAPP = 2---->marker  
LINAPP = 3---->line and marker  
type:INTEGER
```

DISCUSSION: This section describes some often desirable features:

Numeric Axis In Decreasing Order

The user may desire a plot with an axis which has decreasing tick mark values. An example of this often occurs when plotting wind tunnel "pressure distribution". The user can inform the LEZLIN routine to plot with axes decreasing by passing the minimum greater than the maximum for the appropriate axis (dependent or independent). For example, to obtain a decreasing dependent axis with tick mark values from 10 to -10, pass DEPMIN as 10 and DEPMAX as -10. Similarly, to obtain a decreasing independent axis with tick mark values from 10 to -10, pass INDMIN as 10 and INDMAX as -10.

Automatic Scaling of An Axis

The LEZLIN routine can be informed to "automatically scale" an axis. This means the routine will find the minimum and maximum value of a data set, and adjust the number of major tick marks and their labels to provide a "pleasing" plot. The number of "adjusted" tick marks will range from 2 to 11, while the tick mark labels will have suitable increments (conforming to publication standards), and be represented by sufficient number of digits.

For example, to automatically scale the dependent axis in increasing order, DEPMIN and DEPMAX should be set to the same positive value (a real number 0 or greater). To automatically scale the dependent axis in decreasing order, DEPMIN and DEPMAX should be set to the same negative value (a real number less than 0).

Note, the axis scales will only consider the dependent and independent arrays provided with the LEZLIN routines. Thus, subsequent data arrays input with LEZDAT may lie outside the "adjusted" set of ranges.

RESTRICTIONS: By default, both axes will be drawn with 11 major tick marks positioned beginning at INDMIN(DEPMIN) and ending at INDMAX(DEPMAX). There will be one minor tick mark in each major tick mark division (Total of 10).

The dependent and independent arrays are limited to 2 to 500 points.

ERRORS:

LEZLIN: NVALS EXCEEDS LIMIT OF maxpts
PROGRAM TERMINATED.

LEZLIN: NVALS MUST BE 1 OR GREATER (INTEGER).
PROGRAM TERMINATED.

LEZLIN: INDHV OUT OF RANGE SHOULD EQUAL 1 OR 2.
PROGRAM TERMINATED.

LEZLIN: LINAPP OUT OF RANGE; SHOULD = 1, 2, OR 3.
PROGRAM TERMINATED.

LEZLIN: ERROR DURING OPEN.
UNIT= leziou; FILE="leziof".
OPEN STATEMENT NOT PROCESSED.

NOTE: The title of the chart is placed according to
publication standards at the bottom of the page.

There is a limit of 500 points in the data arrays.

LEZLOG - Establish The Chart As A Log Graph

LANGUAGE: FORTRAN 77

PURPOSE: To establish the chart as a LOG(base10) graph.

USE: CALL LEZLOG(INDARY,DEPARY,NVALS,TITLE,IAXLBL,DAXLBL,
 INDMIN,INDMAX,DEPMIN,DEPMAX,IAXTYP,IHLOGI,
 IVLOGI,INDHV,LINAPP)

WHERE: INDARY - The log graph independent variable
 data set.
 type:REAL

 DEPARY - The log graph dependent variable
 data set.
 type:REAL

 NVALS - The number of values in INDARY and
 DEPARY.
 type:INTEGER

 TITLE - A DI-3000 text string to be used as
 the title line in the chart.
 type:CHARACTER

 IAXLBL,
 DAXLBL - DI-3000 text string to be used. The
 independent and dependent axis
 labels, respectively.
 type:CHARACTER

 INDMIN,
 INDMAX - The minimum and maximum values for
 the independent variable axis.
 type:REAL

 DEPMIN,
 DEPMAX - The minimum and maximum values for
 the independent variable axis.
 type:REAL

 IAXTYP - Axis type (linear or logarithmic)
 1 - Logarithmic independent axis
 Linear dependent axis
 2 - Linear independent axis
 Logarithmic dependent axis
 3 - Logarithmic independent axis
 Linear dependent axis

 IHLOGI,

IVLOGI - Tick mark label type, which are:

- 0 - No small tick marks
- 1 - 1,2,3,4,5,6,7,8,9,1
- 2 - 1,2,4,6,8,1
- 3 - 1,3,5,7,9,1
- 4 - 1,5,1
- 5 - 1,1
- 6 - 2,3,4,5,6,7,8,9
- 7 - 2,4,6,8
- 8 - 3,5,7,9
- 9 - 5

If (I LOGI<0)only small log tick marks are drawn.

If (I LOGI>0)Labels and tick marks are drawn.

type: INTEGER

INDHV - An indicator of whether the independent variable should be placed on the horizontal or the vertical axis.

INDHV = 1---->HORIZONTAL

INDHV = 2---->VERTICAL.

type: INTEGER

LINAPP - A line appearance indicator for the curve to be drawn.

LINAPP = 1---->LINE

LINAPP = 2---->MARKER

LINAPP = 3---->LINE AND MARKER.

type: INTEGER

RESTRICTIONS: If the desired axes endpoints are to be different from the maximum and minimum data, put the desired endpoints into INDMIN, INDMAX, DEPMIN, and DEPMAX. LEZLOG will always generate whole integer exponents based on INDMIN, INDMAX, DEPMIN, and DEPMAX where appropriate.

ERRORS:

LEZLOG: NVALS EXCEEDS LIMIT OF maxpts
PROGRAM TERMINATED.

LEZLOG: NVALS MUST BE 1 OR GREATER (INTEGER).
PROGRAM TERMINATED.

LEZLOG: IHLLOGI OUT OF RANGE
SHOULD BE AN INTEGER BETWEEN -9 AND 9
PROGRAM TERMINATED.

LEZLOG: IVLOGI OUT OF RANGE
SHOULD BE AN INTEGER BETWEEN -9 AND 9
PROGRAM TERMINATED.

LEZLOG: IAXTYP OUT OF RANGE
SHOULD EQUAL AN INTEGER 1,2, OR 3
PROGRAM TERMINATED.

LEZLOG: INDHV OUT OF RANGE; SHOULD EQUAL 1 OR 2.
PROGRAM TERMINATED.

LEZLOG: LINAPP OUT OF RANGE; SHOULD = 1, 2, OR 3.
PROGRAM TERMINATED.

LEZLOG: ERROR DURING OPEN.
UNIT= leziou; FILE="leziou".
OPEN STATEMENT NOT PROCESSED.
FATAL INTERNAL ERROR. PLEASE CONTACT SUPPORT GROUP.
PROGRAM TERMINATED.

NOTES: The title of the chart is placed according to
publication standards at the bottom of the page.

LEZNOT - Define And Position A Note On The Current Chart

LANGUAGE FORTRAN 77

PURPOSE: To define and position a note on the current chart.

The text supplied by LEZNOT is not retained internally, and thus must be reentered if the chart is altered.

USE: CALL LEZNOT(STRING,XPOS,YPOS,IHJST,IVJST,IANG)

WHERE: STRING - A DI-3000 text string to be output
 or the current graph.
 type: CHARACTER

 XPOS,
 YPOS - The location on the page to be used
 as the justification point for the
 note.
 type: REAL

 IHJST,
 IVJST - The horizontal and vertical justifi-
 cation, respectively, to be used for
 a string about the point designated
 by XPOS, YPOS.

 IHJST = 1 --> left

 IHJST = 2 --> center

 IHJST = 3 --> right

 IVJST = 1 --> bottom

 IVJST = 2 --> center

 IVJST = 3 --> top

 type: INTEGER

 IANG - The angle of rotation about which to
 display the text.
 type: INTEGER

RESTRICTIONS: None.

ERRORS:

LEZNOT: (XPOS,YPOS)=(xpos,ypos) NOT ON PAGE
 CALL TO LEZNOT IGNORED.

LEZNOT: IHJST OR VJST OUT OF RANGE
 SHOULD BE AN INTEGER BETWEEN 1 & 3
 CALL TO LEZNOT IGNORED.

NOTE: The string is displayed when LEZNOT is called,
 not by LEZSHW.

LEZSIZ may be called prior to this routine to change
the text height, width, and gap.

LEZOPT - Set Options to Change the Appearance of the Current Chart

LANGUAGE: FORTRAN 77

PURPOSE: Set options to change the appearance of the
 current chart.

USE: CALL LEZOPT(OPTION, IVALS)

WHERE : OPTION - A variable to designate which parameter
 is to be changed in the options list.

BFILLD ---> Whether to fill pies, bars, or
 "between" lines.
CLEAR ---> If LEZSHW is to clear the screen
 after display
COLOR ---> Interior color (pies, bars, lines)
DASH ---> Dashed lines from major tick marks
 perpendicular to the dependent axis
HAXCOL ---> Horizontal axis color
HAXLEN ---> Change length of horizontal axis
HAXTCOL ---> Horizontal axis text color
HTICPOS ---> Change tick mark position in
 relation to the horizontal axis.
HTLABR ---> Rotate text on horizontal axis
INTPAT ---> Interior pattern (pies, bars, lines)
KEYJUST ---> Select the justification point for
 location of key
LINPAT ---> Line pattern for line plots
NOTECOL ---> Color of the string output by LEZNOT
PAUSE ---> If LEZSHW is to pause after display
PLOTYP ---> Plot type (i.e. symbol at every nth
 data point)
RADIUS ---> Change radius of pie
RTAXIS ---> Draw second vertical axis
SYMNUM ---> Symbol number (for line plots)
SYMSIZ ---> Symbol size (for line plots)
VAXCOL ---> Vertical axis color
VAXLEN ---> Change length of vertical axis
VAXTCOL ---> Vertical axis text color
VLABDR ---> Set justification of vertical
 axis label
VTLABR ---> Rotate text on the vertical axis
VTICPOS ---> Change tick mark position in
 relation to the vertical axis.
XORIGIN ---> Change x coordinate of origin
YORIGIN ---> Change y coordinate of origin
type: CHARACTER

IVALS - The new value(s) for the option
 controlled by OPTION:

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Detailed description of each specific option

OPTION	DESCRIPTION
BFILLD	<p>IVALS - Array of numbers (one for each data set) that will determine if the pie segments, bars, or "between" lines will be filled.</p> <p>0 - do not fill 1 - fill</p> <p>Default: LEZLIN and LEZLOG; array of 0's LEZBAR, LEZLBR, and LEZPIE; array of 1's</p> <p>type: ARRAY OF INTEGERS</p>
CLEAR	<p>VALUE - Clear flag</p> <p>.FALSE.= LEZSHW will not clear the screen .TRUE.= LEZSHW will clear the screen (default)</p> <p>type: LOGICAL</p>
COLOR	<p>IVALS - Array of numbers (one for each data set) that will determine the interior colors for the pie segments, bars, or "between" lines, or the line colors to be used. Must have at least as many values as there are data sets.</p> <p>Default: DI-3000 colors 1-8 (cycled)</p> <p>type: ARRAY OF INTEGERS</p>
DASH	<p>VALUE - Dashed line flag</p> <p>.FALSE. = no dashed lines (default) .TRUE. = dashed lines</p> <p>type: LOGICAL</p>
HAXCOL	<p>IVALS - Horizontal axis color.</p> <p>range: 0 to 32767 Default: 0 (device normal)</p> <p>type: INTEGER</p>
HAXLEN	<p>IVALS - Horizontal axis length in page coordinates.</p> <p>Default: 2./3. of page width</p> <p>type: REAL</p>
HAXTCOL	<p>IVALS - Horizontal axis text color.</p> <p>range: 0 to 32767 Default: 0 (device normal)</p> <p>type: INTEGER</p>
HTICPOS	<p>IVALS - Tick mark position on horizontal axis</p> <p>0 - Tick marks are suppressed. 1 - Tick marks are positioned to above the axis</p>

(i.e. inward).

2 - Tick marks are positioned to below the axis (i.e. outward).

3 - Tick marks are positioned both above and below the axis (i.e. in and out).

Default:

LEZBAR and LEZLBR; 0 for independent axis
1 for dependent axis

LEZLIN and LEZLOG; 1 for both axes

type: INTEGER

HTLABR IVALS - Rotation angle-horizontal axis
rotates the tick mark labels
Default: 0 degrees from the horizontal
type: INTEGER

INTPAT IVALS - Array of numbers (one for each
data set) that will determine
the interior patterns for the pie
segments, bars, or "between" lines
to be used.
Must have at least as many values
as there are data sets.
Default:
DI-3000 interior fill patterns 13-28
type: ARRAY OF INTEGERS

KEYJUST IVALS - Select the justification point of the
key.
1 - lower left corner
2 - lower right corner
3 - upper left corner
4 - upper right corner (default)
type: INTEGER

LINPAT IVALS - Array of numbers (one for each
data set) that will determine
the line patterns used in line plots.
Must have at least as many values
as there are data sets.
Default:
NASA publication line patterns
1-8 (cycled)
type: ARRAY OF INTEGERS

NOTECOL IVALUE - Color to output LEZNOT string.
range: 0 to 32676
default: 0 (device normal)
type: INTEGER

PAUSE VALUE - Pause flag

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.FALSE.=LEZSHW will not pause after display
 .TRUE.=LEZSHW will pause after display(default)
 type: LOGICAL

PLOTTYP VALUE - Plot type. Determines which data point to place a symbol (i.e. a value of 2, means to plot a symbol at every other data point).
 range: 0 or greater
 default: 1 (every data point)
 type: INTEGER

RADIUS IVALS - Radius of pie in page coordinates.
 Default: 2./9. of smaller page dimension
 type: REAL

RTAXIS VALUE - Axis flag
 .FALSE.=second vertical axis not drawn(default)
 .TRUE.=second vertical axis drawn
 type: LOGICAL

SYMNUM VALUE - Symbol number per data set for line plots.
 Range: must be zero or greater.
 Must have at least as many values as there are data sets.
 Default:
 NASA publication symbols 1-8 (cycled)
 type: ARRAY OF INTEGER

SYMSIZ VALUE - Symbol size in terms of page coordinates.
 Range: must be zero or greater.
 Must have at least as many values as there are data sets.
 Default:
 Publication quality size
 type: ARRAY OF REAL

VAXCOL IVALS - Vertical axis color.
 range: 0 to 32767
 Default: 0 (device normal)
 type: INTEGER

VAXLEN IVALS - Vertical axis length in page coordinates.
 Default: 2./3. of page height
 type: REAL

VAXTCOL IVALS - Vertical axis text color.
 range: 0 to 32767
 Default: 0 (device normal)
 type: INTEGER

VLABDR VALUE - Vertical axis label justification
 .FALSE. - Vertical direction (default)
 .TRUE. - Horizontal direction
 type: LOGICAL

- For options RADIUS, HAXLEN, and VAXLEN IVAL must be greater than zero.
- Options HAXLEN, VAXLEN, XORIGIN, and YORIGIN are inter-related, care must be taken as to the order in which the options are called. If the origin plus the length of the axis exceeds the page size, at any time, the option being called will be ignored, and the current value of that variable will not be changed.

ERRORS:

- LEZOPT: INVALID VALUE FOR OPTION "RADIUS".
THE CURRENT RADIUS OF radius WILL BE USED.
- LEZOPT: INVALID VALUE FOR OPTION "HAXLEN".
THE LENGTH OF THE HORIZONTAL AXIS EXCEEDS PAGE WIDTH.
THE ATTEMPTED HORIZONTAL LENGTH = rvalue
THE CURRENT X-ORIGIN IS ox
THE CURRENT PAGE WIDTH IS pgwid
THE CURRENT AXIS LENGTH OF xdist WILL BE USED.
- LEZOPT: INVALID VALUE FOR OPTION "HAXLEN".
LENGTH OF THE HORIZONTAL AXIS IS LESS THAN
OR EQUAL TO ZERO.
THE CURRENT AXIS LENGTH OF xdist WILL BE USED.
- LEZOPT: INVALID VALUE FOR OPTION "VAXLEN".
THE LENGTH OF THE VERTICAL AXIS EXCEEDS
THE PAGE HEIGHT.
THE ATTEMPTED VERTICAL LENGTH = rvalue
THE CURRENT Y-ORIGIN IS oy
THE CURRENT PAGE HEIGHT IS pghgt
THE CURRENT AXIS LENGTH OF ydist WILL BE USED.
- LEZOPT: INVALID VALUE FOR OPTION "VAXLEN".
LENGTH OF THE VERTICAL AXIS IS LESS THAN
OR EQUAL TO ZERO.
THE CURRENT AXIS LENGTH OF ydist WILL BE USED.
- LEZOPT: INVALID VALUE FOR OPTION "HAXCOL".
INVALID VALUE = ',ivalue
VALID RANGE: INTEGER 0-32767.
CALL TO LEZOPT IGNORED.
- LEZOPT: INVALID VALUE FOR OPTION "HAXTCOL".
INVALID VALUE = ',ivalue
VALID RANGE: INTEGER 0-32767.
CALL TO LEZOPT IGNORED.
- LEZOPT: INVALID VALUE FOR OPTION "VAXCOL".
INVALID VALUE = ',ivalue
VALID RANGE: INTEGER 0-32767.
CALL TO LEZOPT IGNORED.

LEZOPT: INVALID VALUE FOR OPTION "VAXTCO".
 INVALID VALUE = ',ivalue
 VALID RANGE: INTEGER 0-32767.
 CALL TO LEZOPT IGNORED.

LEZOPT: INVALID VALUE FOR OPTION "NOTECOL".
 INVALID VALUE = ',ivalue
 VALID RANGE: INTEGER 0-32767.
 CALL TO LEZOPT IGNORED.

LEZOPT: INVALID VALUE FOR OPTION "PLOTYP".
 VALID RANGE: INTEGER 0 OR GREATER.
 INVALID VALUE = ivalue
 DATA SET = ki
 THE CURRENT VALUE OF plotyp(ki) IS USED.

LEZOPT: INVALID VALUE FOR OPTION "XORIGIN".
 THE LENGTH OF THE HORIZONTAL AXIS EXCEEDS
 THE PAGE WIDTH.
 THE ATTEMPTED XORIGIN = rvalue
 THE CURRENT X-AXIS LENGTH IS xdist
 THE CURRENT PAGE WIDTH IS pgwid
 THE CURRENT AXIS ORIGIN OF ox WILL BE USED.

LEZOPT: INVALID VALUE FOR OPTION "YORIGIN".
 THE LENGTH OF THE VERTICAL AXIS EXCEEDS
 THE PAGE HEIGHT.
 THE ATTEMPTED YORIGIN = rvalue
 THE CURRENT Y-AXIS LENGTH IS ydist
 THE CURRENT PAGE HEIGHT IS pghgt
 THE CURRENT AXIS ORIGIN OF oy WILL BE USED.

LEZOPT: INVALID VALUE FOR OPTION "HTICPOS".
 VALID RANGE: INTEGER 1-3
 CALL TO LEZOPT IGNORED.

LEZOPT: INVALID VALUE FOR OPTION "VTICPOS".
 VALID RANGE: INTEGER 1-3
 CALL TO LEZOPT IGNORED.

LEZOPT: INVALID VALUE FOR OPTION "KEYJUST".
 VALID RANGE: 1-4 INTEGER.
 INVALID VALUE = ivalue
 CALL TO LEZOPT IGNORED.

LEZOPT: INVALID VALUE FOR OPTION "BFILLD".
 VALID RANGE: INTEGER 0 OR 1.
 INVALID VALUE = ivalue
 DATA SET = ki
 THE CURRENT VALUE OF bfilld(ki) IS USED.

LEZOPT: INVALID VALUE FOR OPTION "COLOR".
 VALID RANGE: INTEGER 0 TO 32767.
 INVALID VALUE = ivalue

DATA SET = ki
THE CURRENT VALUE OF intcol(ki) IS USED.

LEZOPT: INVALID VALUE FOR OPTION "INTPAT".
VALID RANGE: INTEGER 0 TO 32767.
INVALID VALUE = ivalue
DATA SET = ki
THE CURRENT VALUE OF intpat(ki) IS USED.

LEZOPT: INVALID VALUE FOR OPTION "SYMNUM".
VALID RANGE: INTEGER 0 TO 922.
INVALID VALUE = ivalue
DATA SET = ki
THE CURRENT VALUE OF symnum(ki) IS USED.

LEZOPT: INVALID VALUE FOR OPTION "LINPAT".
VALID RANGE: INTEGER 1 TO 8.
INVALID VALUE = ivalue
DATA SET = ki
THE CURRENT VALUE OF linpat(ki) IS USED.

LEZOPT: INVALID VALUE FOR OPTION "SYMSIZ".
VALID RANGE: REAL 0 OR GREATER.
INVALID VALUE = rvalue
DATA SET = ki
THE CURRENT VALUE OF symsiz(ki) IS USED.

LEZOPT: INVALID OPTION "option".
CALL TO LEZOPT IGNORED.

LEZPGE - Change The Default Page Size

LANGUAGE FORTRAN 77

PURPOSE: To change the default page size.
Note, this routine can be used to control the page size, which in turn defines the aspect ratio of view space.

USE: CALL LEZPGE (XVAL,YVAL)

WHERE: XVAL - The width of the page in the X-direction.

YVAL - The height of the page in the Y-direction.

RESTRICTIONS:

This routine can only be called once, and must be the first routine that is called (i.e. before LEZINI).

ERRORS:

LEZPGE: LEZPGE MUST BE CALLED BEFORE LEZINI AND CAN ONLY BE CALLED ONCE. THIS CALL TO LEZPGE IS IGNORED.

LEZPGE: XVAL=xval AND YVAL=yval
DO NOT MAKE AN ACCEPTABLE PAGE.
CALL TO LEZPGE IGNORED.

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LEZPIE - Establish The Chart As A Pie Graph

LANGUAGE: FORTRAN 77

PURPOSE: To establish the chart as a pie graph.

USE: CALL LEZPIE(SEGS, NUM, TITLE, NEXP1, NEXP2, LFORM1, LFORM2)

where: SEGS - The array of values to be used in
 generating the pie segments.
 type:REAL

 NUM - The number of values in the array
 SEGS.
 type:INTEGER

 TITLE - Main graph title.
 type:CHARACTER

 NEXP1 - The number of the first segment to
 be included in an exploded segment.
 type:INTEGER

 NEXP2 - The number of the last segment to
 be included in an exploded segment.
 type:INTEGER

 LFORM1 - An indicator of whether to display
 a quantity label for each segment
 of the pie.
 LFORM1 = 0 ----->Do not display
 label
 LFORM1 = 1 ----->Display label
 type:INTEGER

 LFORM2 - An indicator of whether to
 display a percentage label for each
 segment of the pie
 LFORM2 = 0 ----->Do not display
 label
 LFORM2 = 1 ----->Display label
 type:INTEGER

RESTRICTIONS: There can be no more than 10 segments in each pie
 chart.

ERRORS:

LEZPIE: INVALID VALUE FOR "NUM" = num
 ENTER AN INTEGER VALUE FROM 1 TO maxpie
 PROGRAM TERMINATED.

LEZPIE: INVALID VALUE FOR "NEXP1" = nexp1
ENTER AN INTEGER FROM 0 TO NUMBER OF
SEGMENTS. (CURRENTLY = numpie)
PROGRAM TERMINATED.

LEZPIE: INVALID VALUE FOR "NEXP2" = nexp2
ENTER AN INTEGER FROM 0 TO NUMBER OF
SEGMENTS. (CURRENTLY = numpie)
PROGRAM TERMINATED.

LEZPIE: INVALID VALUE FOR NEXP1 OR NEXP2
BOTH MUST BE ZERO OR NON-ZERO
NEXP1,NEXP2 = nexp1,nexp2
PROGRAM TERMINATED.

LEZPIE: INVALID VALUE FOR "LFORM1" = lform1
ENTER AN INTEGER VALUE OF 0 OR 1
PROGRAM TERMINATED.

LEZPIE: INVALID VALUE FOR "LFORM2" = lform2
ENTER AN INTEGER VALUE OF 0 OR 1
PROGRAM TERMINATED.

NOTES: The title of the chart is placed according to
publication standards at the bottom of the page.

There are no restrictions on the size and placement
of the pie charts so care must be taken to ensure
that the plot is all contained within the page.
The title will always show up on the plot somewhere,
unless a blank title is used.

LEZPLB - Label A Pie Segment With Text, And/Or Make A Legend Entry

LANGUAGE: FORTRAN 77

PURPOSE: To label a pie segment with text, and/or make a key entry.

USE: CALL LEZPLB(NOPLB,LABEL,KEY)

where: NOPLB - The pie segment with which the labels will be associated.
 type:INTEGER

 LABEL - Text string containing label to be placed beside the pie segment NOPLB.
 type:CHARACTER

 KEY - Text string containing a label to be placed in the key and associated with the pie segment designated by NOPLB.
 type:CHARACTER

RESTRICTIONS: If LABEL is a null string (' '), no label will be placed beside the pie segment. If KEY is a null string, no key entry will be made for pie segment NOPLB. If no key has been created for a graph, KEY will be ignored. Create a chart key by calling LEZKEY.

ERRORS:

LEZPLB: "LEZPIE" MUST BE CALLED PRIOR TO "LEZPLB".
PROGRAM TERMINATED.

LEZPLB: INVALID VALUE FOR "NOPLB" = noplb
ENTER AN INTEGER FROM 1 TO NUMBER OF
SEGMENTS (CURRENTLY = numpie)
CALL TO LEZPLB IGNORED.

LEZPQP - Obtain Pie Segment Quantity And Percent Labels

LANGUAGE: FORTRAN 77

PURPOSE: To obtain pie segment quantity and percent labels.

USE: CALL LEZPQP(N1,FORM1,N2,FORM2)

Where: N1 - The total number of characters to be
 used when displaying the pie segment
 quantity label.
 type:INTEGER

 FORM1 - The FORTRAN format specification to
 be used for the quantity value.
 type:CHARACTER

 N2 - The total number of characters to be
 used when plotting the pie segment.
 type:INTEGER

 FORM2 - The FORTRAN format specification
 used for the percentage values.
 type:CHARACTER

RESTRICTIONS: None.

ERRORS:

LEZPQP: "LEZPIE" MUST BE CALLED PRIOR TO "LEZPQP".
PROGRAM TERMINATED.

LEZPQP: INVALID VALUE FOR "N1" = n1
ENTER AN INTEGER VALUE FROM 0 TO 40
CALL TO LEZPQP IGNORED.

LEZPQP: INVALID VALUE FOR "N2" = n2
ENTER AN INTEGER VALUE FROM 0 TO 40
CALL TO LEZPQP IGNORED.

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LEZSHW - Draw Current Chart

LANGUAGE: FORTRAN 77

PURPOSE: Draw current chart.
By default, LEZSHW will pause then clear the screen.
LEZOPT provides options which will disable the pause
and/or clear, then subsequently allow the user to
enable them. The pause and clear is performed
through LEZSHW.

USE: CALL LEZSHW

RESTRICTIONS: LEZSHW draws the chart as it is currently
defined by all previous LEZ calls.

Call LEZSHW more than once between LEZ
initialization(LEZINI) and termination(LEZTRM).
Other LEZ routines may be called to further
specify the chart between calls to LEZSHW. This
would allow the viewing of the chart as each new
annotation is specified.

ERRORS: None.

LEZSIZ - Change The Current Character Height And Width.

LANGUAGE: FORTRAN 77

PURPOSE: Change the current character height and width.

USE: CALL LEZSIZ(XSIZE,YSIZE)

WHERE: XSIZE - Character width (in page coordinates).
Range: greater than or equal to zero.
type: REAL

YSIZE - Character height (in page coordinates).
Range: greater than or equal to zero.
type: REAL

RESTRICTION: XSIZE and YSIZE must be greater than zero.

ERRORS:

LEZSIZ: INVALID ARGUMENT IN LEZSIZ.
XSIZE SHOULD BE A REAL VALUE 0 OR MORE.
XSIZE NOT CHANGED.

LEZSIZ: INVALID ARGUMENT IN LEZSIZ.
YSIZE SHOULD BE A REAL VALUE 0 OR MORE.
YSIZE NOT CHANGED.

NOTES: To return the character height to its default,
 enter the value of zero for YSIZE.
 To return the character width to its default,
 enter the value of zero for XSIZE.

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LEZTRM - Terminate The Graphics Routines

LANGUAGE: FORTRAN 77

PURPOSE: To terminate the graphics routines. LEZTRM ensures that all graphic output is completed and terminates the underlying LEZ, CGL, and DI-3000 support systems.

USE: CALL LEZTRM

RESTRICTIONS: LEZTRM must be the last LEZ routine called by the application program. You may call LEZINI afterward to begin creation of a new chart.

ERRORS:
 LEZTRM: INTERNAL ERROR DURING FILE CLOSE.
 CONTACT PROGRAM ADMINISTRATOR.

APPENDIX B

TEST CASES AND CHARTS OF THE LEZ ROUTINES

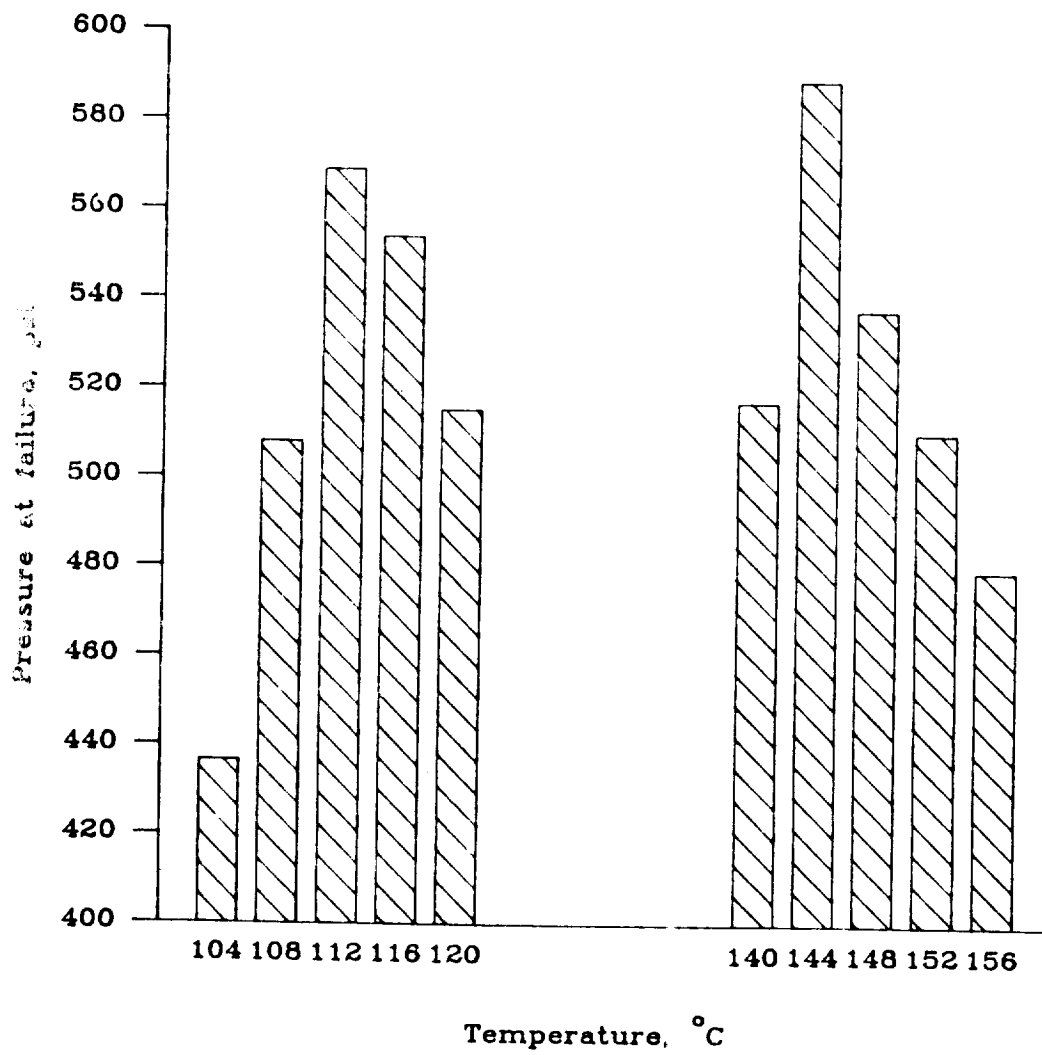
This appendix contains two sets of sample programs which use the LEZ routines. The first set, consists of the programs used to generate the charts used in section 3 (i.e. lines, bars, pies, and composite charts). The programs are commented more fully to aid the user in understanding the use of the LEZ routines. These programs have the same names used in section 3 (i.e. DCLIN1, DCBAR1, DCMIX1, etc.).

DCBAR1 - Basic bar chart using LEZBAF	B - 3
DCBAR2 - Bar chart using LEZAXN	B - 6
DCBAR3 - Bar chart using LEZAXT	B - 9
DCBAR4 - Basic bar chart using LEZLBR	B - 12
DCBAR5 - Absolute bar chart with a key (LEZKEY and LEZDAT)	B - 15
DCBAR6 - Additive bar chart with a key (LEZKEY and LEZDAT)	B - 18
DCLIN1 - Basic line chart	B - 21
DCLIN2 - Line chart with an autoscaled axis	B - 24
DCLIN3 - Line chart with a decreasing axis	B - 27
DCLIN4 - Line chart with numeric axes (LEZAXN)	B - 30
DCLIN5 - Line chart with character axis (LEZAXT)	B - 33
DCLIN6 - Multi-line chart with a key (LEZKEY and LEZDAT)	B - 36
DCLOG1 - Basic semi-logarithmic chart (logarithmic dependent axis)	B - 40
DCMIX1 - Multiple linear charts	B - 44
DCPIE1 - Pie chart with quantity, percentage, and segment labels	B - 49
DCPIE2 - Exploded pie chart with quantity, percentage, and segment labels	B - 52
DCPIE3 - Pie chart with quantity and percentage labels and a key (LEZKEY)	B - 55

The second set consists of additional programs which reveal some of the LEZ routine capabilities, possibly not indicated earlier.

CGBAR1 - Multiple bar charts with rotated tick mark labels	B - 58
CGBAR2 - Multiple absolute bar charts with a key	B - 63
CGBAR3 - Multiple additive bar charts with a key	B - 69
CGLIN1 - Multi-line chart with an autoscaled axis and a key	B - 75
CGLIN2 - Multi-line chart with a key and reordered line patterns	B - 79
CGLIN3 - Multi-line chart with a key and dashed lines across the data space	B - 81
CGLIN4 - Multi-line chart with pattern fill between lines and a key	B - 87
CGLIN5 - Multi-line chart with a decreasing axis and a key	B - 94
CGMIX1 - Multi-chart chart (pie, bar, and linear charts)	B - 96
CGMIX2 - Multi-chart chart (linear and logarithmic charts)	B - 105
CGMIX3 - Multi-chart chart (pie, bar, and linear charts on two pages)	B - 107
CGPIE1 - Pie chart with segment labels	B - 119
CGPIE2 - Pie chart with quantity, percentage, and segment labels with a key	B - 127
CGPIE3 - Two exploded pie charts with quantity and percentage labels with a key	B - 129
CGPIE4 - Pie chart with segment and quantity labels	B - 131

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Low pressure fatigue testing

DCBAR1

PROGRAM DCBAR1

```

C-----
C
C THIS EXAMPLE DRAWS THE BASIC BAR CHART.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZBAR (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT DATA MINIMUM,
C         INDMAX - INDEPENDENT DATA MAXIMUM,
C         DEPMIN - DEPENDENT DATA MINIMUM,
C         DEPMAX - DEPENDENT DATA MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         IBRAPP - APPEARANCE INDICATOR 0:UNFILLED 1:FILLED)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZSHW
C
C LEZTRM
C-----

```

C---DATA SECTION---

```

      REAL INDMAX,INDMIN,TEMP(10),PRESS(10)

      CHARACTER IAXLBL*80,DAXLBL*80,TITLE*80

      DATA TEMP /104.,108.,112.,116.,120.,140.,144.,148.,152.,156./
      DATA PRESS /436.55,507.95,568.95,554.,515.3,517.25,589.35,537.04,
+          510.45,479.7/

```

INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

      IDEV = 1
      CALL LEZINI (IDEV)

```

C---SET UP LABELED BAR GRAPH---

```

      NVALS = 10
      TITLE = 'LOW PRESSURE FATIGUE TESTING'
      IAXLBL = 'TEMPERATURE, [BSUP]O[ESUP][ELC]C'
      DAXLBL = 'PRESSURE AT FAILURE, PSI'
      INDMIN = 100.

```

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```

INDMAX = 160.
DEPMIN = 400.
DEPMAX = 600.
INDHV = 1
IBRAPP = 1
CALL LEZBAR(TEMP,PRESS,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+          DEPMIN,DEPMAX,INDHV,IBRAPP)

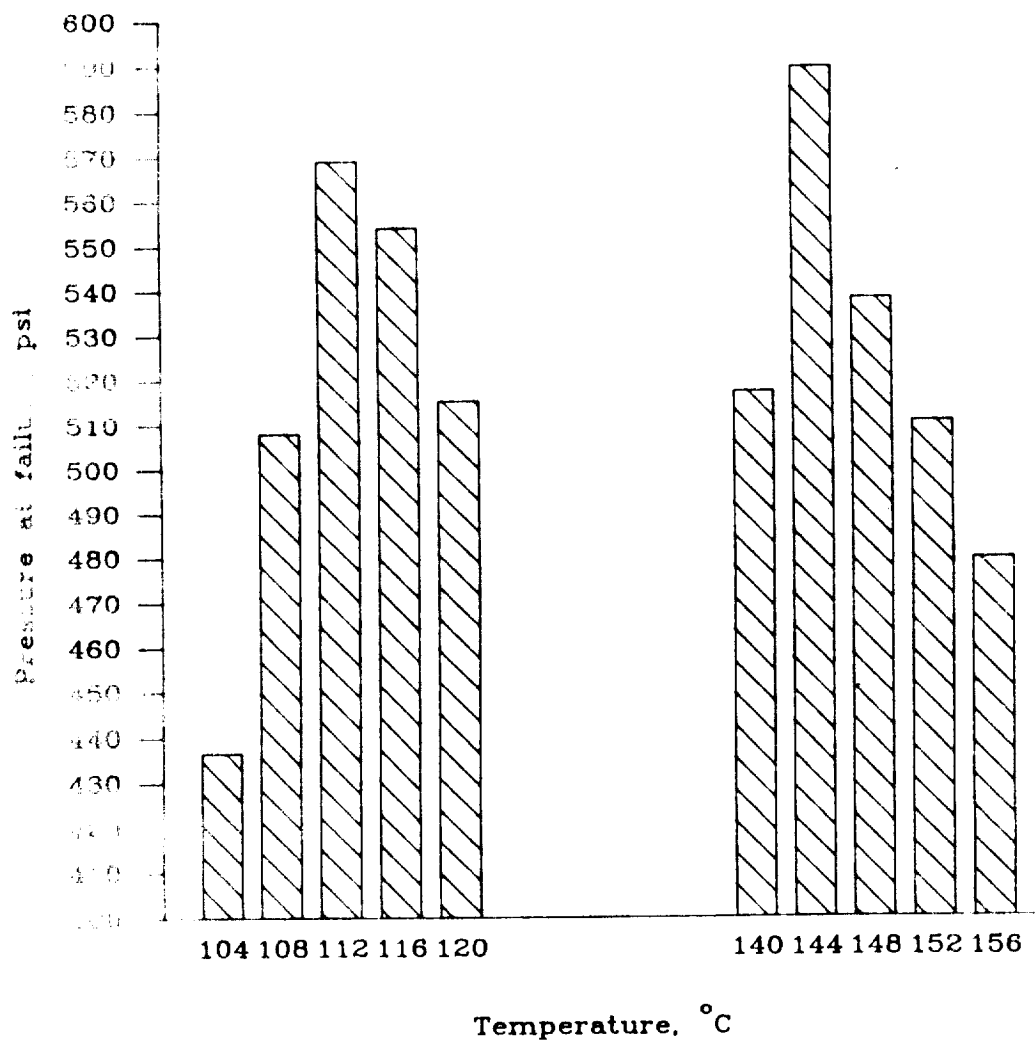
CALL LEZNOT('DCBAR1',7.,0.,3,1,0)
C---SHOW GRAPH---

CALL LEZSHW

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

CALL LEZTRM
STOP
END

```



Low pressure fatigue testing

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```

C-----
C
C THIS EXAMPLE DRAWS A BAR CHART USING LEZAXN FOR THE INDEPENDENT AXIS.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (1HV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINC - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         NMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZBAR (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT DATA MINIMUM,
C         INDMAX - INDEPENDENT DATA MAXIMUM,
C         DEPMIN - DEPENDENT DATA MINIMUM,
C         DEPMAX - DEPENDENT DATA MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         IBRAPP - APPEARANCE INDICATOR 0:UNFILLED 1:FILLED)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZSHW
C
C LEZTRM
C-----
C---DATA SECTION---
      REAL INDMAX,INDMIN,TEMP(10),PRESS(10)

      CHARACTER IAXLBL*80,DAXLBL*80,TITLE*80

      DATA TEMP /104.,108.,112.,116.,120.,140.,144.,148.,152.,156./
      DATA PRESS /436.55,507.95,568.45,554.,515.3,517.25,589.35,537.95,
+           510.45,479.7/

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---
      IDEV = 1
      CALL LEZINI (IDEV)

```

C---SET UP LABELED BAR GRAPH---

```
NVALS = 10
TITLE = 'L[BLC]OW PRESSURE FATIGUE TESTING'
IAXLBL = 'T[BLC]EMPERATURE, [BSUP]O[ESUP][ELC]C'
DAXLBL = 'P[BLC]RESSURE AT FAILURE, PSI'
INDMIN = 100.
INDMAX = 160.
DEPMIN = 400.
DEPMAX = 600.
INDHV = 1
IBRAPP = 1
CALL LEZBAR(TEMP,PRESS,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,INDHV,IBRAPP,
+          DEPMIN,DEPMAX,INDHV,IBRAPP)
```

C---SET UP A NUMERIC AXIS---

```
IHV = 2
NDEC = -3
TSTART = 400.
TINCR = 10.
TEND = 600.
NTMINR = 0
CALL LEZAXN (IHV,NDEC,TSTART,TINCR,TEND,NTMINR)
```

```
CALL LEZNOT('DCBAR2',7.,0.,3,1,0)
```

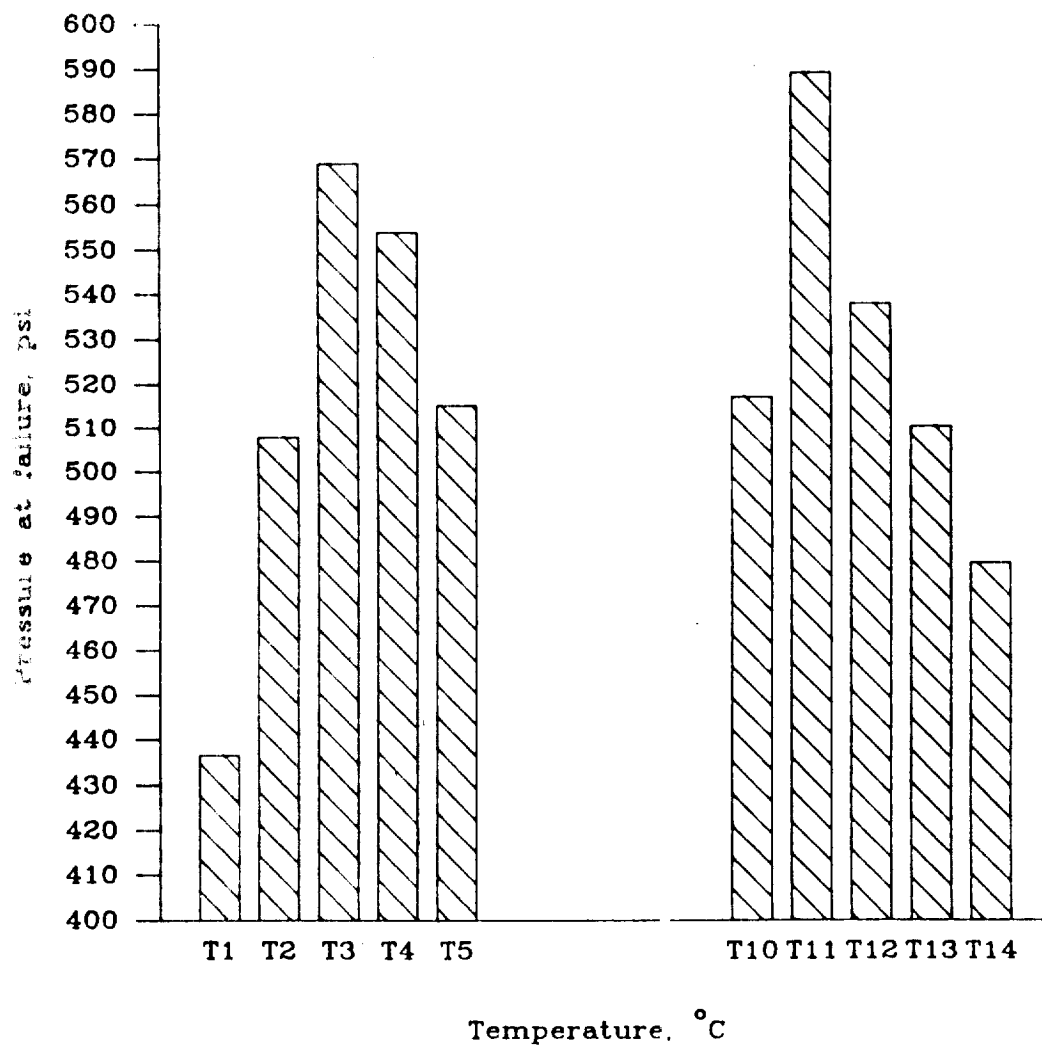
C---SHOW GRAPH---

```
CALL LEZSHW
```

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```
CALL LEZTRM
STOP
END
```

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Low pressure fatigue testing

DCBAR3

PROGRAM DCBAR3

```

C-----
C
C THIS EXAMPLE DRAWS A BAR CHART USING LEZAXT FOR THE CHARACTER
C INDEPENDENT AXIS.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINCR - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZAXT (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NLABS - NUMBER OF TICK MARK LABELS IN STRING,
C         LABELS - TICK MARK LABELS,
C         NTMAJR - NUMBER OF MAJOR TICK MARKS,
C         NTMINR - NUMBER OF MINOR TICK MARK PER INCREMENT)
C
C LEZBAR (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT DATA MINIMUM,
C         INDMAX - INDEPENDENT DATA MAXIMUM,
C         DEPMIN - DEPENDENT DATA MINIMUM,
C         DEPMAX - DEPENDENT DATA MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL
C         IBRAPP - APPEARANCE INDICATOR 0:UNFILLED 1:FILLED)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZSHW
C
C LEZTRM
C-----

```

DATA SECTION---

```

REAL      INDMAX,  INDMIN
REAL      TEMP(10), PRESS(10)

```

```

CHARACTER*80  IAXLBL,  DAXLBL,  TITLE,  LABEL

```

```

DATA TEMP /104.,108.,112.,116.,120.,140.,144.,148.,152.,156.

```

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DATA PRESS /436.55,507.95,568.95,554.,515.3,517.25,589.35,537.95,
+ 510.45,479.7/

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

IDEV = 1
CALL LEZINI (IDEV)

C---SET UP LABELED BAR GRAPH---

NVALS = 10
TITLE = 'L[BLC]OW PRESSURE FATIGUE TESTING'
IAXLBL = 'T[BLC]EMPERATURE, [BSUP]O[ESUP][ELC]C'
DAXLBL = 'P[BLC]RESSURE AT FAILURE, PSI'
INDMIN = 100.
INDMAX = 160.
DEPMIN = 400.
DEPMAX = 600.
INDHV = 1
IBRAPP = 1
CALL LEZBAR(TEMP,PRESS,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+ DEPMIN,DEPMAX,INDHV,IBRAPP)

C---SET UP CHARACTER AXIS---

IHV = 1
NLABS = 15
LABELS = '\$ \$T1\$T2\$T3\$T4\$T5\$ \$ \$ \$ \$T10\$T11\$T12\$T13\$T14\$'
NTMAJR = 16
NTMINR = 1
CALL LEZAXT (IHV,NLABS,LABELS,NTMAJR,NTMINR)

C---CREATE A NUMERIC AXIS---

IHV = 2
NDEC = -3
TSTART = 400.
TINCR = 10.
TEND = 600.
NTMINR = 0
CALL LEZAXN (IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

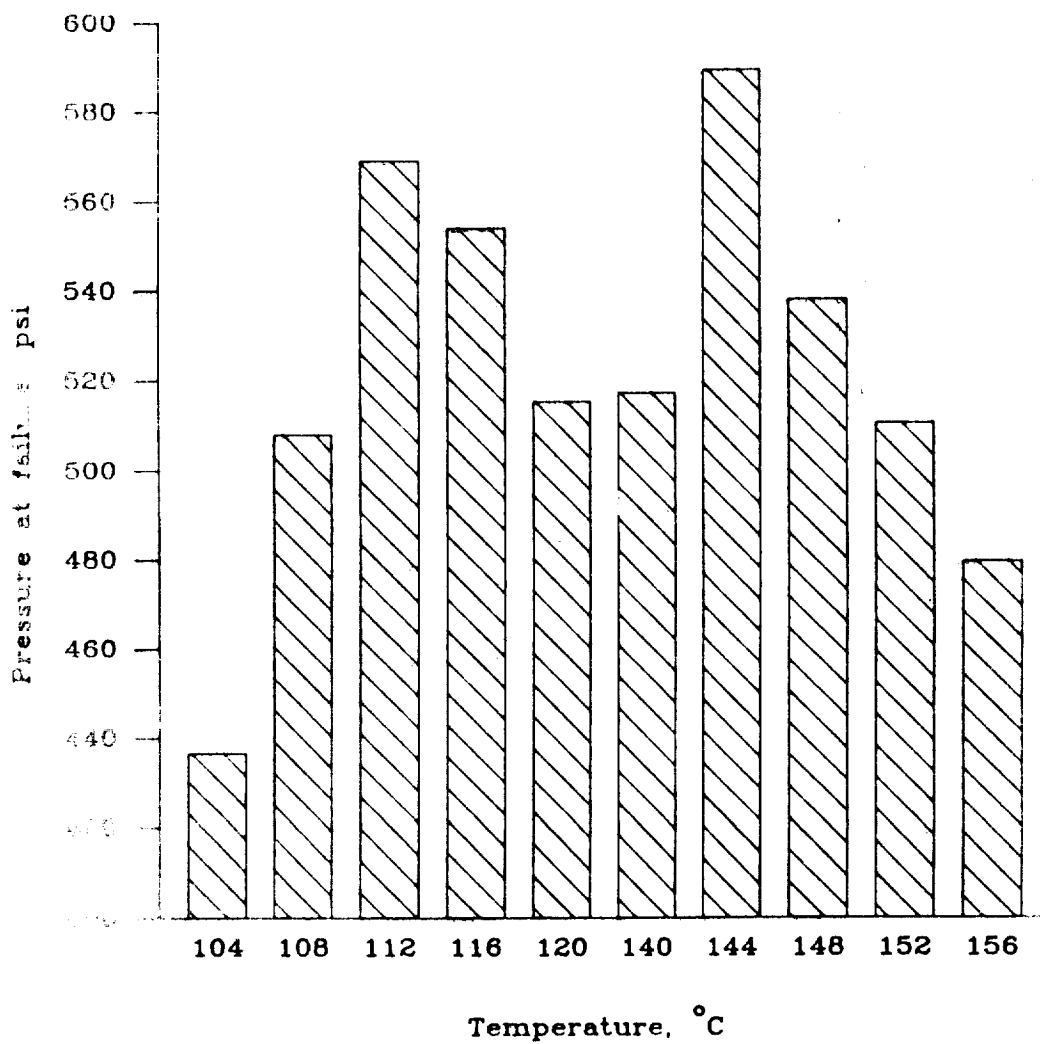
CALL LEZNOT('DCBAR3',7.,0.,3,1,0)

C---SHOW GRAPH---

CALL LEZSHW

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

CALL LEZTRM
STOP
END



Low pressure fatigue testing

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PROGRAM DCBAR4

```

C-----
C
C THIS EXAMPLE DRAWS A BAR CHART USING LEZLBR FOR THE CHARACTER
C INDEPENDENT AXIS.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C          0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZLBR (VALUES - DEPENDENT DATA SET,
C          NVALS - NUMBER OF DATA VALUES,
C          TITLE - TITLE OF GRAPH,
C          LABELS - TICK MARK LABELS,
C          IAXLBL - INDEPENDENT AXIS LABEL,
C          DAXLBL - DEPENDENT AXIS LABEL,
C          VALMIN - DEPENDENT DATA MINIMUM,
C          VALMAX - DEPENDENT DATA MAXIMUM,
C          INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C          IBRAPP - APPEARANCE INDICATOR 0:UNFILLED 1:FILLED)
C
C LEZSHW
C
C LEZTRM
C-----

```

C---DATA SECTION---

```

      REAL      TEMP(10), PRESS(10)

      CHARACTER*80  IAXLBL,  DAXLBL,  TITLE,  LABELS

      DATA TEMP /104.,108.,112.,116.,120.,140.,144.,148.,152.,156./
      DATA PRESS /436.55,507.95,568.95,554.,515.3,517.25,589.35,537.95,
+          510.45,479.7/

```

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

      IDEV = 1
      CALL LEZINI (IDEV)

```

C---SET UP LABELED BAR GRAPH---

```

      NVALS = 10
      TITLE = 'LOW PRESSURE FATIGUE TESTING'
      LABELS = '$104$108$112$116$120$140$144$148$152$156$'
      IAXLBL = 'TEMPERATURE, [BSUP]O[ESUP][ELC]C'
      DAXLBL = 'PRESSURE AT FAILURE, PSI'
      VALMIN = 400.

```

```

      VALMAX = 600.
      INDHV = 1
      IBRAPP = 1

      CALL LEZLBR(PRESS,NVALS,TITLE,LABELS,IAXLBL,DAXLBL,
+              VALMIN,VALMAX,INDHV,IBRAPP)

      CALL LEZNOT('DCBAR4',7.,0.,3,1,0)
C---SHOW GRAPH---

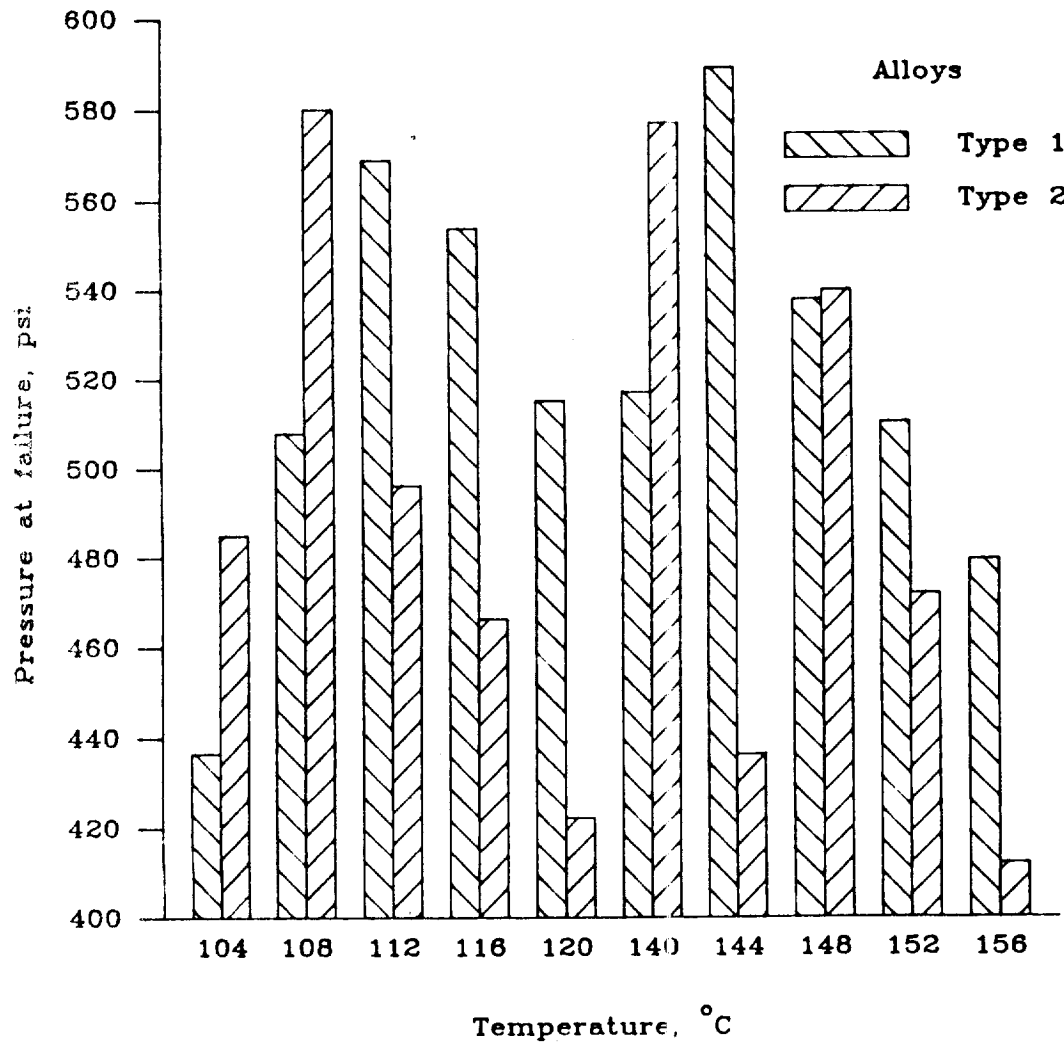
      CALL LEZSHW

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

      CALL LEZTRM
      STOP
      END

```

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Low pressure fatigue testing

DCBAR5

PROGRAM DCBAR5

```

C-----
C
C THIS EXAMPLE DRAWS A BAR CHART WITH A KEY AND A CHARACTER
C INDEPENDENT AXIS.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZDAT (DEPARY - ADDITIONAL DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         IDTREL - RELATIONSHIP BETWEEN DEPENDENT DATA SETS
C                 1:ABSOLUTE 2:ADDITIVE,
C         IDTAPP - APPEARANCE INDICATOR
C                 FOR BARS: 0:UNFILLED 1:FILLED
C                 FOR LINES: 1:LINES 2:MARKERS 3:BOTH,
C         KENTRY - KEY ENTRY LABEL FOR THIS DATA SET)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZKEY (TITLE - TITLE OF GRAPH,
C         XPOS - X POSITION ON THE PAGE,
C         YPOS - Y POSITION ON THE PAGE,
C         KENTRY - FIRST KEY ENTRY LABEL)
C         KEY IS POSITIONED ACCORDING TO THE UPPER RIGHT CORNER
C
C LEZLBR (VALUES - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         TITLE - TITLE OF GRAPH,
C         LABELS - TICK MARK LABELS,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         VALMIN - DEPENDENT DATA MINIMUM,
C         VALMAX - DEPENDENT DATA MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         IBRAPP - APPEARANCE INDICATOR 0:UNFILLED 1:FILLED)
C
C LEZSHW
C
C LEZTRM
C-----

```

C---DATA SECTION---

```

REAL      TEMP(10), PRES1(10), PRES2(10)

CHARACTER*80  KENTRY,  IAXLBL,  DAXLBL,  TITLE,  LABELS

DATA TEMP /104.,108.,112.,116.,120.,140.,144.,148.,152.,156./
DATA PRES1 /436.55,507.95,568.95,554.,515.3,517.25,589.35,537.95,

```



```

+          510.45,479.7/
DATA PRES2 /485.01,580.15,496.33,466.45,422.28,577.16,436.33,
+          540.01,472.03,411.99/

```

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

IDEV = 1
CALL LEZINI (IDEV)

```

C---SET UP LABELED BAR GRAPH---

```

NVALS = 10
TITLE = 'L[BLC]OW PRESSURE FATIGUE TESTING'
LABELS = '$104$108$112$116$120$140$144$148$152$156$'
IAXLBL = 'T[BLC]EMPERATURE, [BSUP]O[ESUP][ELC]C'
DAXLBL = 'P[BLC]RESSURE AT FAILURE, PSI'
VALMIN = 400.
VALMAX = 600.0
INDHV = 1
IBRAPP = 1
CALL LEZLBR(PRES1,NVALS,TITLE,LABELS,IAXLBL,DAXLBL,
+          VALMIN,VALMAX,INDHV,IBRAPP)

```

C---CREATE A KEY---

```

TITLE = 'A[BLC]LLOYS'
XPOS = 6.5
YPOS = 6.2
KENTRY = 'T[BLC]YPE 1'
CALL LEZKEY (TITLE,XPOS,YPOS,KENTRY)

```

C---ADD ADDITIONAL DATA SET---

```

NVALS = 10
IDTREL = 1
IDTAPP = 1
KENTRY = 'T[BLC]YPE 2'
CALL LEZDAT (PRES2,NVALS,IDTREL,IDTAPP,KENTRY)

```

```

CALL LEZNOT('DCBAR5',7.,0.,3,1,0)

```

C---SHOW GRAPH---

```

CALL LEZSHW

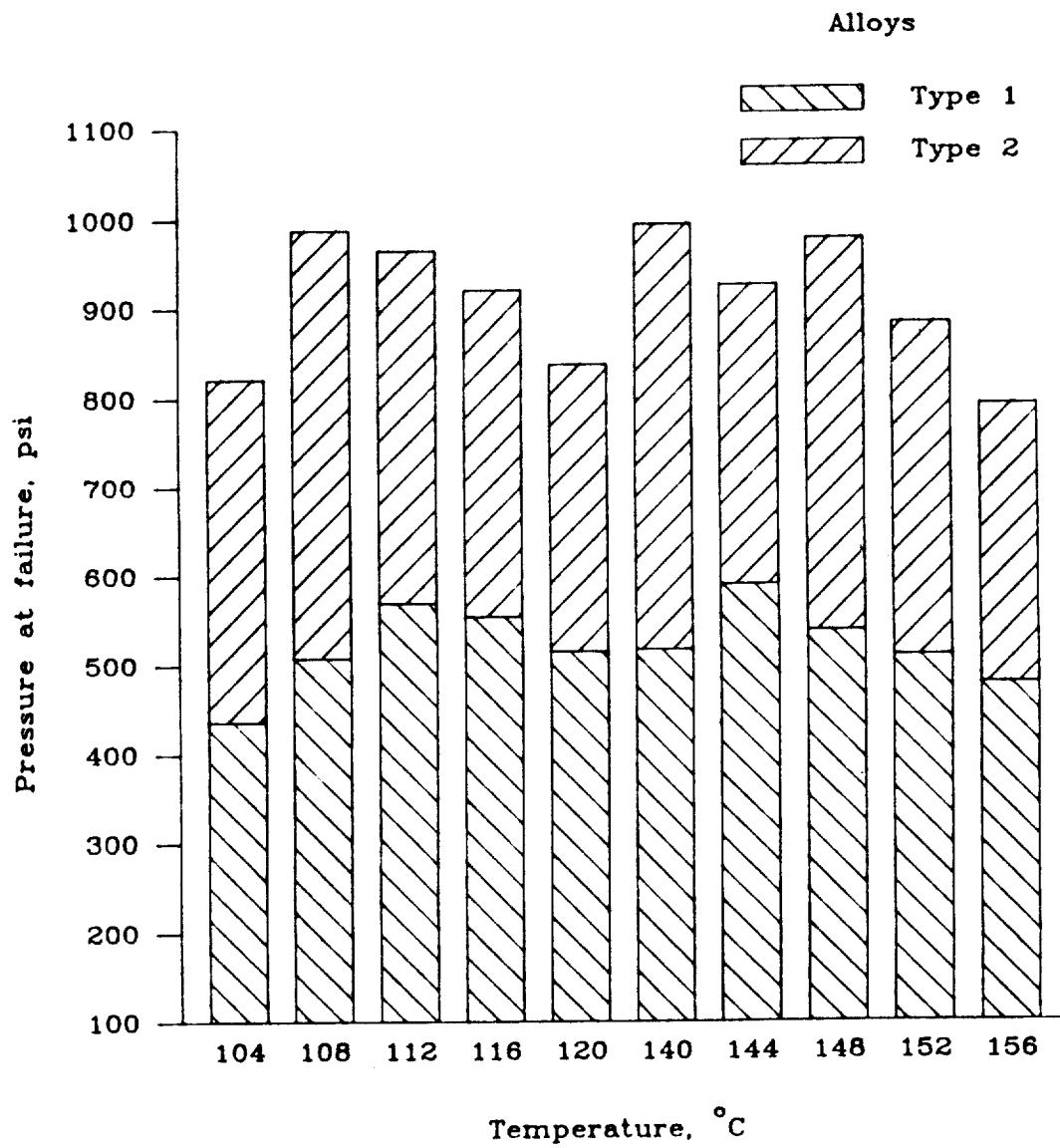
```

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

CALL LEZTRM
STOP
END

```



Low pressure fatigue testing

DCBAR6

PROGRAM DCBAR6

```

C-----
C
C THIS EXAMPLE DRAWS A BAR CHART WITH A KEY AND A CHARACTER
C INDEPENDENT AXIS.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZDAT (DEPARTY - ADDITIONAL DEPENDENT DATA SET,
C          NVALS - NUMBER OF DATA VALUES,
C          IDTREL - RELATIONSHIP BETWEEN DEPENDENT DATA SETS
C                  1:ABSOLUTE 2:ADDITIVE,
C          IDTAPP - APPEARANCE INDICATOR
C                  FOR BARS: 0:UNFILLED 1:FILLED
C                  FOR LINES: 1:LINES 2:MARKERS 3:BOTH,
C          KENTRY - KEY ENTRY LABEL FOR THIS DATA SET)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C          0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZKEY (TITLE - TITLE OF GRAPH,
C          XPOS - X POSITION ON THE PAGE,
C          YPOS - Y POSITION ON THE PAGE,
C          KENTRY - FIRST KEY ENTRY LABEL)
C          KEY IS POSITIONED ACCORDING TO THE UPPER RIGHT CORNER
C
C LEZLBR (VALUES - DEPENDENT DATA SET,
C          NVALS - NUMBER OF DATA VALUES,
C          TITLE - TITLE OF GRAPH,
C          LABELS - TICK MARK LABELS,
C          IAXLBL - INDEPENDENT AXIS LABEL,
C          DAXLBL - DEPENDENT AXIS LABEL,
C          VALMIN - DEPENDENT DATA MINIMUM,
C          VALMAX - DEPENDENT DATA MAXIMUM,
C          INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C          IBRAPP - APPEARANCE INDICATOR 0:UNFILLED 1:FILLED)
C
C LEZSHW
C
C LEZTRM
C-----

```

C---DATA SECTION---

```

REAL      TEMP(10), PRES1(10), PRES2(10)

CHARACTER*80  KENTRY,    IAXLBL,    DAXLBL,    TITLE,    LABELS

DATA TEMP /104.,108.,112.,116.,120.,140.,144.,148.,152.,156./
DATA PRES1 /436.55,507.95,568.95,554.,515.3,517.25,589.35,537.95,

```

```

+          510.45,479.7/
DATA PRES2 /485.01,580.15,496.33,466.45,422.28,577.16,436.33,
+          540.01,472.03,411.99/

```

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

IDEV = 1
CALL LEZINI (IDEV)

```

C---SET UP LABELED BAR GRAPH---

```

NVALS = 10
TITLE = 'L[BLC]OW PRESSURE FATIGUE TESTING'
LABELS = '$104$108$112$116$120$140$144$148$152$156$'
IAXLBL = 'T[BLC]EMPERATURE, [BSUP]O[ESUP][ELC]C'
DAXLBL = 'P[BLC]RESSURE AT FAILURE, PSI'
VALMIN = 100.
VALMAX = 1100.0
INDHV = 1
IBRAPP = 1
CALL LEZLBR(PRES1,NVALS,TITLE,LABELS,IAXLBL,DAXLBL,
+          VALMIN,VALMAX,INDHV,IBRAPP)

```

C---CREATE A KEY---

```

TITLE = 'A[BLC]LLOYS'
XPOS = 6.2
YPOS = 7.0
KENTRY = 'T[BLC]YPE 1'
CALL LEZKEY (TITLE,XPOS,YPOS,KENTRY)

```

C---ADD ADDITIONAL DATA SET---

```

NVALS = 10
IDTREL = 2
IDTAPP = 1
KENTRY = 'T[BLC]YPE 2'
CALL LEZDAT (PRES2,NVALS,IDTREL,IDTAPP,KENTRY)

```

```

CALL LEZNOT('DCBAR6',7.,0.,3,1,0)

```

C---SHOW GRAPH---

```

CALL LEZSHW

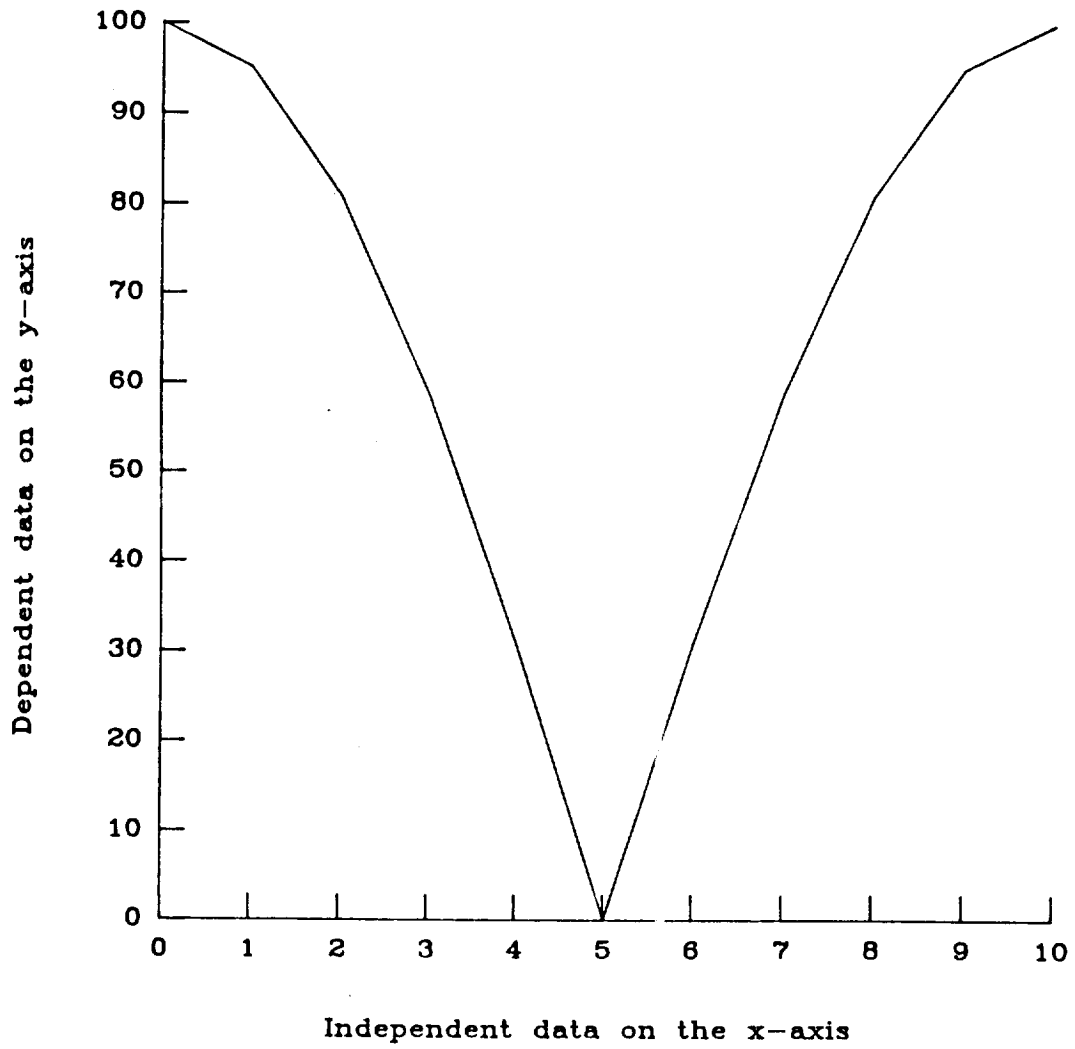
```

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

CALL LEZTRM
STOP
END

```



Plot of $y = |100\cos 18x|$

DCLIN1

```

      PROGRAM DCLINI
C
C-----
C
C THIS EXAMPLE DRAWS A SIMPLE LINE PLOT.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C   NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA PAIRS,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT AXIS MINIMUM,
C         INDMAX - INDEPENDENT AXIS MAXIMUM,
C         DEPMIN - DEPENDENT AXIS MINIMUM,
C         DEPMAX - DEPENDENT AXIS MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C
C LEZSHW
C
C LEZTRM
C
C-----

C---DATA SECTION---

      CHARACTER TITLE*80,IAXLBL*80,DAXLBL*80
      REAL X(0:10),Y(0:10),INDMIN,INDMAX

      DTRAD=ATAN(1.)/45.
      DO 10 I=0,10
        X(I)=REAL(I)
10      Y(I)=ABS(100.*COS(X(I)*18.*DTRAD))

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

      IDEV=1
      CALL LEZINI(IDEV)

C---SET UP A LINE PLOT---

      NVALS=11
      TITLE=
+ 'P[BLC]LOT OF Y=[FONT=24][ELC]B[FONT]100[BLC]COS18X'//
+ '[FONT=24][ELC]B'
      IAXLBL='I[BLC]NDEPENDENT DATA ON THE X-AXIS'

```

```

DAXLBL='D[BLC]EPENDENT DATA ON THE Y-AXIS'
INDMIN=X(0)
INDMAX=X(10)
DEPMIN=Y(5)
DEPMAX=Y(10)
INDHV=1
LINAPP=1
CALL LEZLIN(X,Y,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,
+INDMAX,DEPMIN,DEPMAX,INDHV,LINAPP)

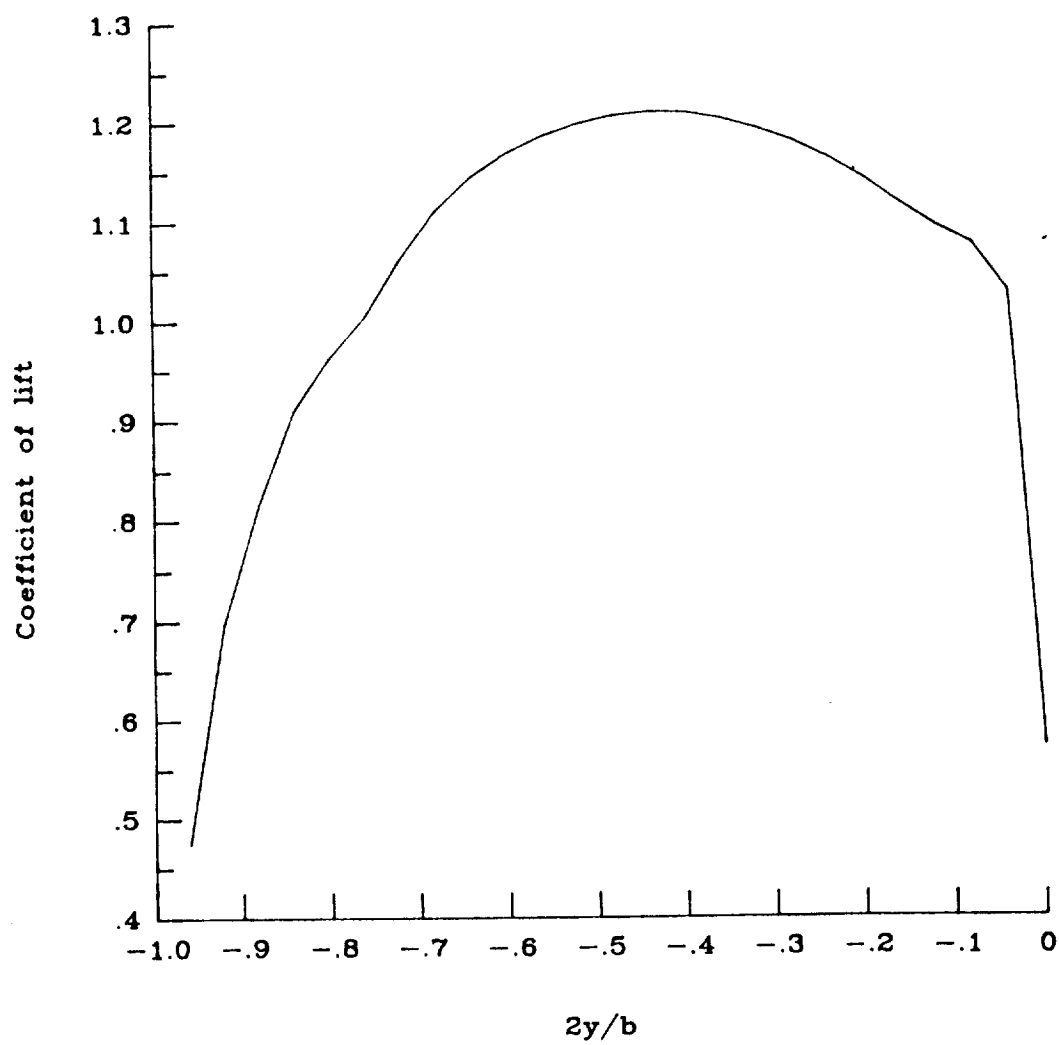
CALL LEZNOT('DCLIN1',7.,0.,3,1,0)
C---SHOW GRAPH---

CALL LEZSHW

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

CALL LEZTRM
STOP
END

```



Vortex flow about a 60° delta wing with $\alpha=20^\circ$

DCLIN2

PROGRAM DCLIN2

```

C-----
C
C THIS EXAMPLE DRAWS A LINE CHART WITH AUTOSCALED HORIZONTAL
C AND VERTICAL AXES.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C   NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA PAIRS,
C         TITLE - TITLE OF CHART,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT AXIS MINIMUM,
C         INDMAX - INDEPENDENT AXIS MAXIMUM,
C         DEPMIN - DEPENDENT AXIS MINIMUM,
C         DEPMAX - DEPENDENT AXIS MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C
C LEZSHW
C
C LEZTRM
C
C-----

```

C---VARIABLE DECLARATION AND INITIALIZATION---

```

      CHARACTER TITLE*256,IAXLBL*80,DAXLBL*80
      REAL SPAN(25),CLIFT(25),INDMIN,INDMAX
      DATA CLIFT/.4748,.6962,.8165,.9102,.9631,1.005,1.063,1.112,
+1.146,1.170,1.187,1.199,1.207,1.210,1.209,1.203,1.193,1.180,
+1.163,1.142,1.117,1.094,1.076,1.028,.5721/
      RI=-1.0
      DO 1 I=1,25
        RI=RI+.04
1      SPAN(I)=RI

```

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

      IDEV=0
      CALL LEZINI(IDEV)

```

C---SET UP A LINE PLOT---

```

C   ESTABLISH CHART AS A LINE CHART, AND ENTER FIRST DATA SET.
C   *** NOTE: AUTOSCALING AXIS IS OBTAINED BY SETTING 'INDMIN' EQUAL
C           TO 'INDMAX' AND 'DEMIN' EQUAL TO 'DEPMAX'.

```

```

NVALS=25
TITLE='V[BLC]ORTEX FLOW ABOUT A 60[BSUP]O[ESUP] DELTA WING WITH [F
+ONT=9]A[FONT]=20[BSUP]O'
IAXLBL='2[BLC]Y/B'
DAXLBL='C[BLC]OEFFICIENT OF LIFT'
INDMIN=0.
INDMAX=0.
DEPMIN=0.
DEPMAX=0.
INDHV=1
LINAPP=1
CALL LEZLIN(SPAN,CLIFT,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+DEPMIN,DEPMAX,INDHV,LINAPP)

CALL LEZNOT('DCLIN2',7.,0.,3,1,0)
C---SHOW CHART---

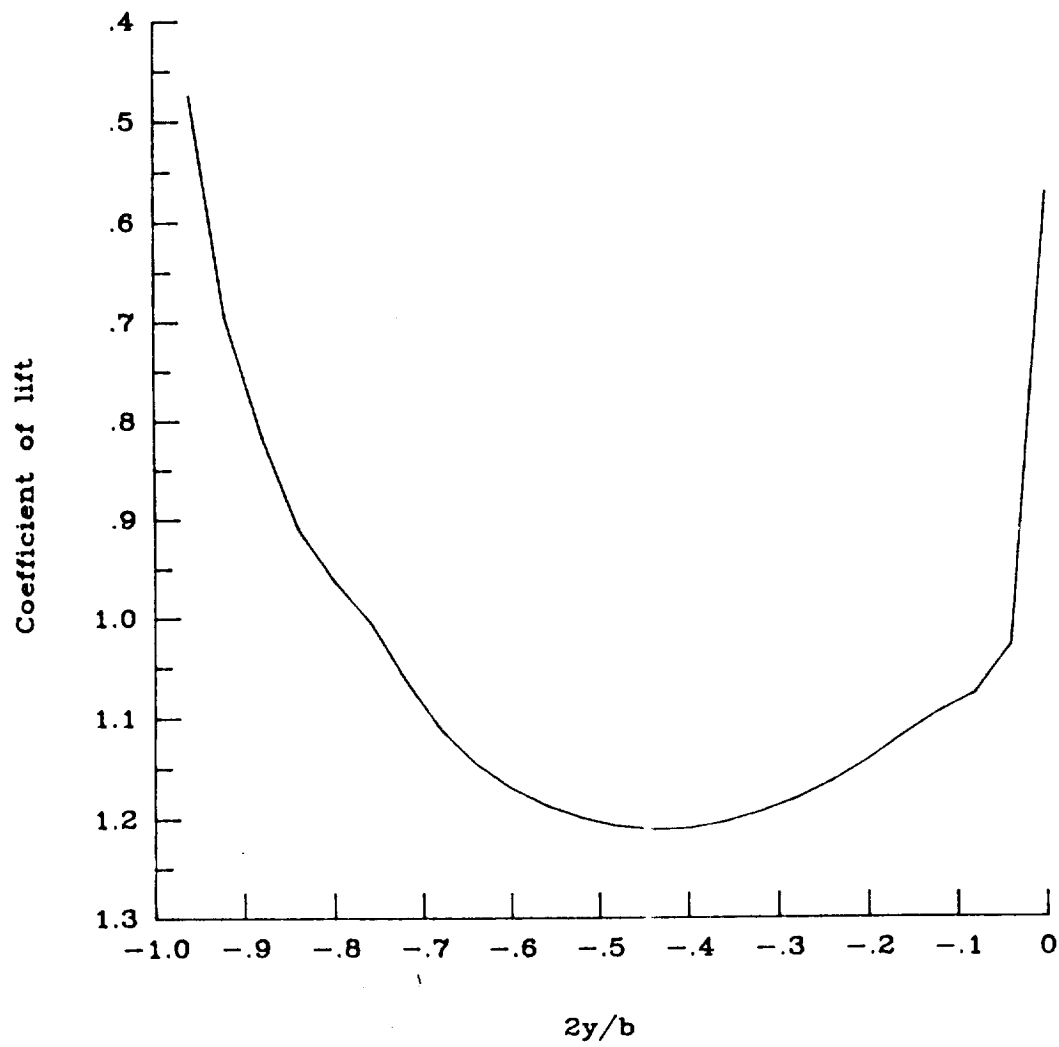
CALL LEZSHW

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

CALL LEZTRM
STOP
END

```

ORIGINAL PAGE IS
OF POOR QUALITY



Vortex flow about a 60° delta wing with $\alpha=20^\circ$

DCLIN3

```

      PROGRAM DCLIN3
C
C-----
C
C THIS EXAMPLE DRAWS A LINE CHART WITH A DECREASING VERTICAL AXIS.
C THE COMMENTS IN THIS PROGRAM EMPHASIZE DECREASING AXES.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C     NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA PAIRS,
C         TITLE - TITLE OF CHART,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT AXIS MINIMUM,
C         INDMAX - INDEPENDENT AXIS MAXIMUM,
C         DEPMIN - DEPENDENT AXIS MINIMUM,
C         DEPMAX - DEPENDENT AXIS MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C
C LEZSHW
C
C LEZTRM
C
C-----

C---VARIABLE DECLARATION AND INITIALIZATION---

      CHARACTER TITLE*256,IAXLBL*80,DAXLBL*80
      REAL SPAN(25),CLIFT(25),INDMIN,INDMAX
      DATA CLIFT/.4748,.6962,.8165,.9102,.9631,1.005,1.063,1.112,
+1.146,1.170,1.187,1.199,1.207,1.210,1.209,1.203,1.193,1.180,
+1.163,1.142,1.117,1.094,1.076,1.028,.5721/
      RI=-1.0
      DO 1 I=1,25
        RI=RI+.04
1      SPAN(I)=RI

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

      IDEV=0
      CALL LEZINI(IDEV)

C---SET UP A LINE PLOT---
C   ESTABLISH CHART AS A LINE CHART, AND ENTER FIRST DATA SET.
C   *** NOTE: DECREASING AXIS IS OBTAINED BY SETTING 'DEPMIN' TO BE
C             GREATER THAN 'DEPMAX', OR AS IN THIS CASE, 'DEPMIN'

```

```

C                                AND 'DEPMAX' EQUAL TO -1 (FOR AN AUTOSCALED AXIS).

      NVALS=25
      TITLE='V[BLC]ORTEX FLOW ABOUT A 60[BSUP]O[ESUP] DELTA WING WITH [F
+ONT=9]A[FONT]=20[BSUP]O'
      IAXLBL='2[BLC]Y/B'
      DAXLBL='C[BLC]OEFFICIENT OF LIFT'
      INDMIN=-1.
      INDMAX=0.
      DEPMIN=-1.0
      DEPMAX=-1.0
      INDHV=1
      LINAPP=1
      CALL LEZLIN(SPAN,CLIFT,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+DEPMIN,DEPMAX,INDHV,LINAPP)

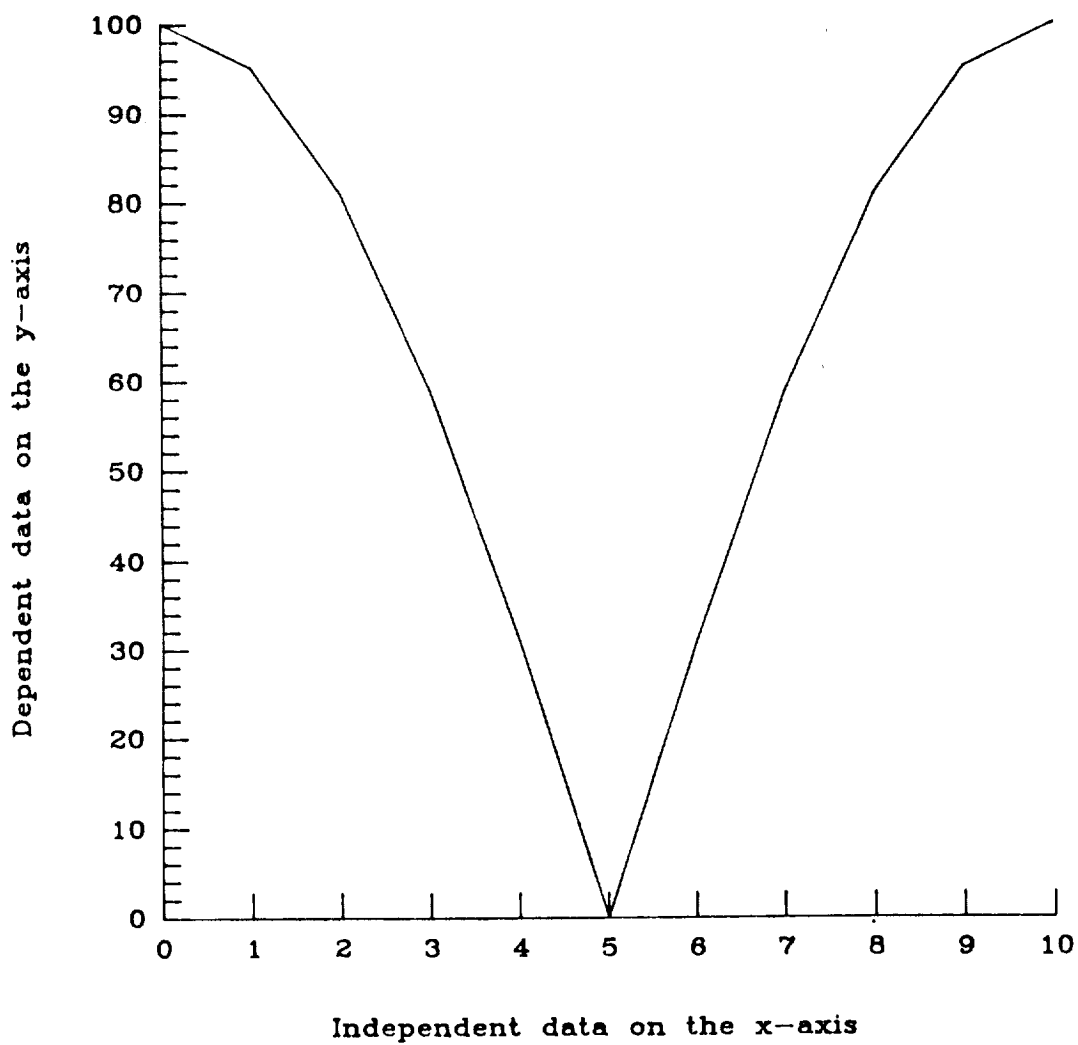
      CALL LEZNOT('DCLIN3',7.,0.,3,1,0)
C---SHOW CHART---

      CALL LEZSHW

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

      CALL LEZTRM
      STOP
      END

```



Plot of $y = |100\cos 18x|$

DCLIN4

PROGRAM DCLIN4

```

C-----
C
C THIS EXAMPLE DRAWS A LINE CHART WITH NUMERIC AXES.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C     NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINC - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA PAIRS,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT AXIS MINIMUM,
C         INDMAX - INDEPENDENT AXIS MAXIMUM,
C         DEPMIN - DEPENDENT AXIS MINIMUM,
C         DEPMAX - DEPENDENT AXIS MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C
C LEZSHW
C
C LEZTRM
C-----

```

C---DATA SECTION---

```

      CHARACTER TITLE*80,IAXLBL*80,DAXLBL*80
      REAL X(0:10),Y(0:10),INDMIN,INDMAX

      DTRAD=ATAN(1.)/45.
      DO 10 I=0,10
        X(I)=REAL(I)
10      Y(I)=ABS(100.*COS(X(I)*18.*I TRAD))

```

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

      IDEV=1
      CALL LEZINI(IDEV)

```

C---SET UP A LINE PLOT---

```
NVALS=11
TITLE=
+ 'P[BLC]LOT OF Y=[FONT=24][ELC]B[FONT]100[BLC]COS18X'//
+ '[FONT=24][ELC]B'
IAXLBL='I[BLC]NDEPENDENT DATA ON THE X-AXIS'
DAXLBL='D[BLC]EPENDENT DATA ON THE Y-AXIS'
INDMIN=X(0)
INDMAX=X(10)
DEPMIN=Y(5)
DEPMAX=Y(10)
INDHV=1
LINAPP=1
CALL LEZLIN(X,Y,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,
+INDMAX,DEPMIN,DEPMAX,INDHV,LINAPP)
```

C---CREATE A NUMERIC AXIS---

```
IHV=2
NDEC=-3
TSTART=Y(5)
TINCR=10.0
TEND=Y(10)
NTMINR=4
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)
```

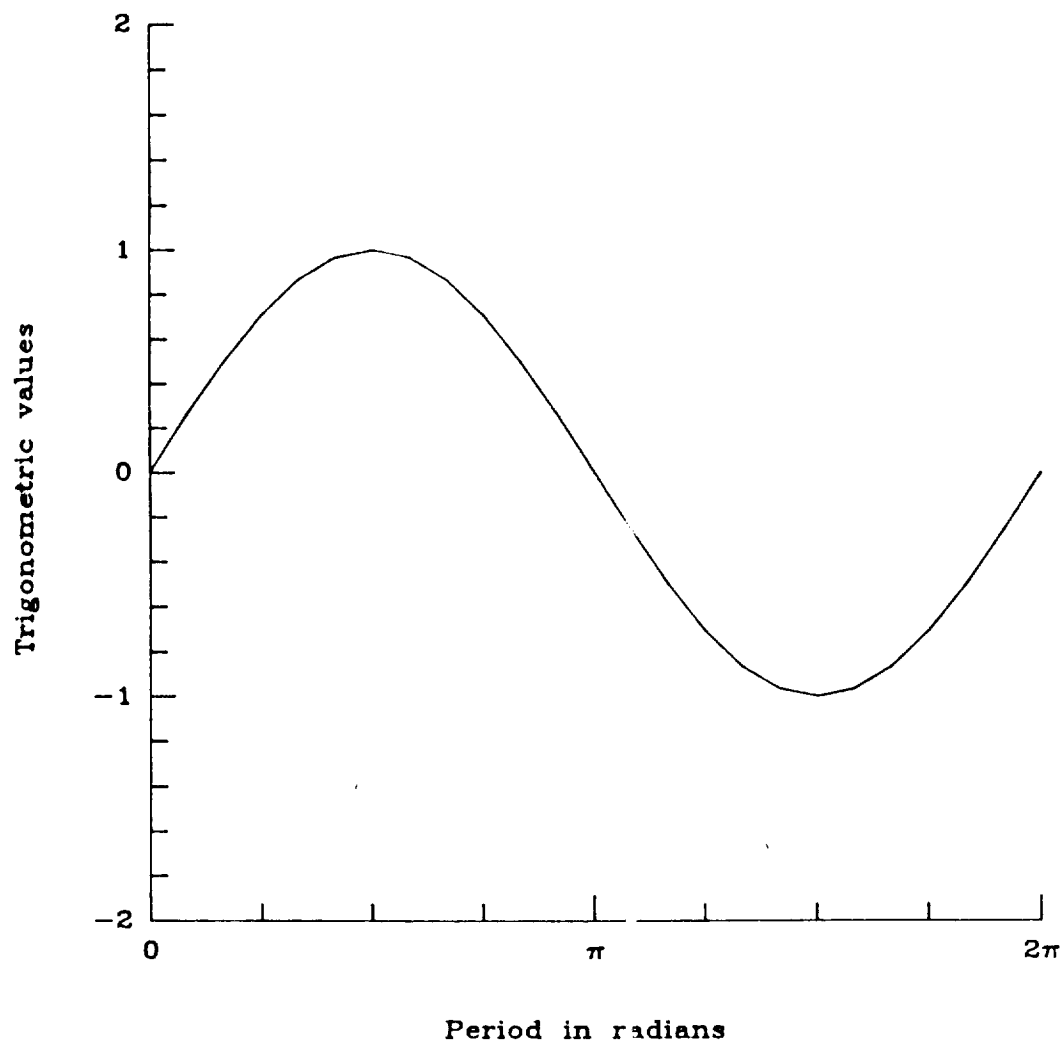
```
CALL LEZNOT('DCLIN4',7.,0.,3,1,0)
```

C---SHOW GRAPH---

```
CALL LEZSHW
```

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```
CALL LEZTRM
STOP
END
```

Sine plot

DCLIN5

PROGRAM DCLIN5

```

C-----
C
C THIS EXAMPLE DRAWS A SIMPLE LINE CHART WITH CHARACTER AND NUMERIC AXES
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C   NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINCR - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZAXT (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NLABS - NUMBER OF TICK MARK LABELS IN STRING,
C         LABELS - TICK MARK LABELS,
C         NTMAJR - NUMBER OF MAJOR TICK MARKS,
C         NTMINR - NUMBER OF MINOR TICK MARK PER INCREMENT)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA PAIRS,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT AXIS MINIMUM,
C         INDMAX - INDEPENDENT AXIS MAXIMUM,
C         DEPMIN - DEPENDENT AXIS MINIMUM,
C         DEPMAX - DEPENDENT AXIS MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C
C LEZSHW
C
C LEZTRM
C-----

```

C---DATA SECTION---

```

CHARACTER TITLE*80,IAXLBL*80,DAXLBL*80,LABELS*80
REAL PI(25),SSIN(25),INDMIN,INDMAX

WPI=ACOS(-1.)
DO 10 I=1,25
RI=I
PI(I)=(RI-1.)*(WPI/12.)

```

```

        SSIN(I)=SIN(PI(I))
10      CONTINUE

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

        IDEV=1
        CALL LEZINI(IDEV)

C---SET UP A LINE PLOT

        NVALS=25
        TITLE='S{BLC}INE PLOT'
        IAXLBL='P{BLC}ERIOD IN RADIANS'
        DAXLBL='T{BLC}RIGONOMETRIC VALUES'
        INDMIN=PI(1)
        INDMAX=PI(25)
        DEPMIN=-2.0
        DEPMAX=2.0
        INDHV=1
        LINAPP=1
        CALL LEZLIN(PI,SSIN,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,
+INDMAX,DEPMIN,DEPMAX,INDHV,LINAPP)

C---CREATE A CHARACTER AXIS---

        IHV=1
        NLABS=3
        LABELS='Q$[FONT=9]{BLC}Q$2[FONT=9]{BLC}Q$'
        NTMAJR=3
        NTMINR=3
        CALL LEZAXT(IHV,NLABS,LABELS,NTMAJR,NTMINR)

C---CREATE A NUMERIC AXIS---

        IHV=2
        NDEC=-1
        TSTART=-2.0
        TINCR=1.0
        TEND=2.0
        NTMINR=4
        CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

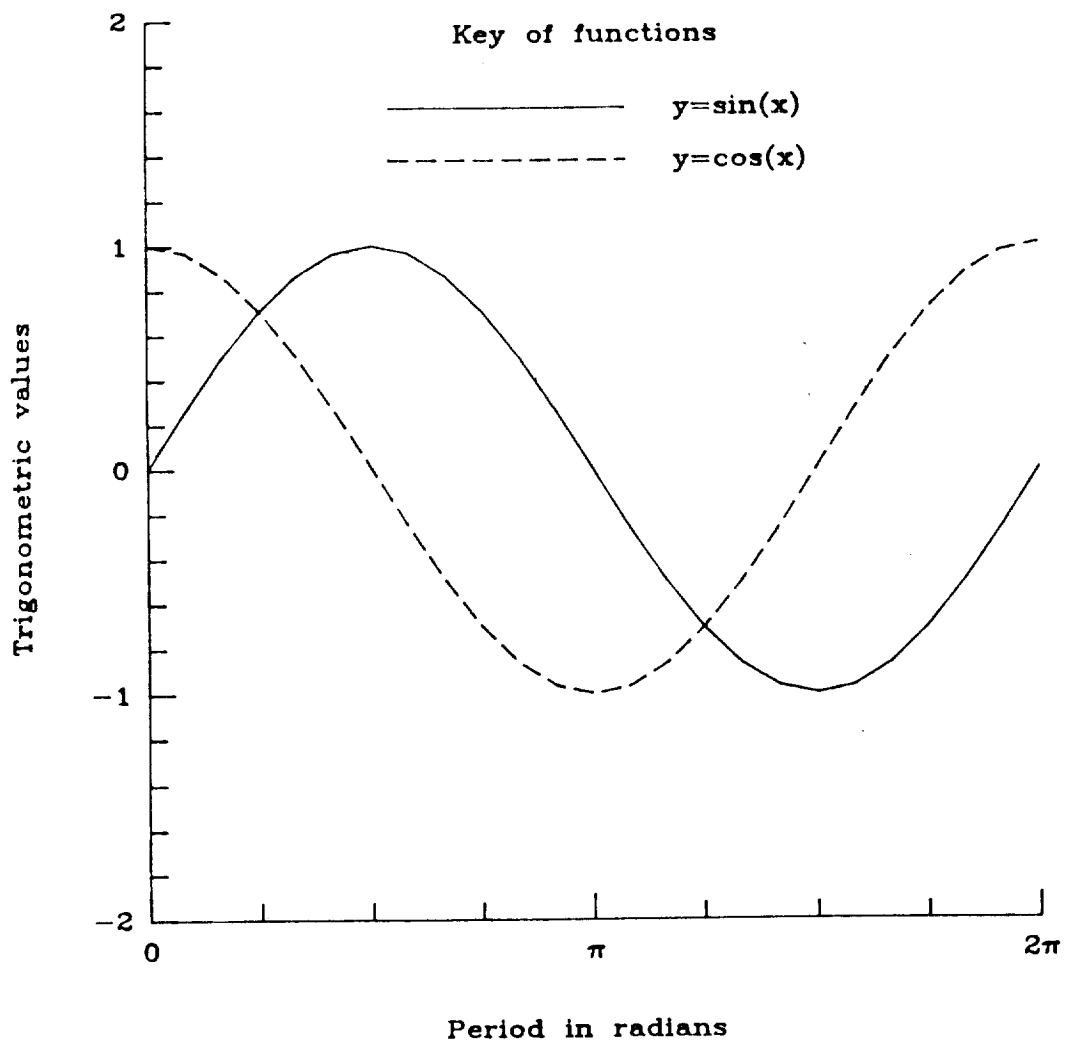
        CALL LEZNOT('DCLIN5',7.,0.,3,1,0)
C---SHOW GRAPH---

        CALL LEZSHW

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

        CALL LEZTRM
        STOP
        END

```



Plot of trigonometric functions

DCLIN6

PROGRAM DCLIN6

```

C-----
C
C THIS EXAMPLE DRAWS A MULTI-LINE CHART WITH A KEY.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C     NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINC - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZAXT (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NLABS - NUMBER OF TICK MARK LABELS IN STRING,
C         LABELS - TICK MARK LABELS,
C         NTMAJR - NUMBER OF MAJOR TICK MARKS,
C         NTMINR - NUMBER OF MINOR TICK MARK PER INCREMENT)
C
C LEZDAT (DEPARY - ADDITIONAL DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         IDTREL - RELATIONSHIP BETWEEN DEPENDENT DATA SETS
C               1:ABSOLUTE 2:ADDITIVE,
C         IDTAPP - APPEARANCE INDICATOR
C               FOR BARS: 0:UNFILLED 1:FILLED
C               FOR LINES: 1:LINES 2:MARKERS 3:BOTH,
C         KENTRY - KEY ENTRY LABEL FOR THIS DATA SET)
C
C LEZINI (IDDEV - DI-3000 LOGICAL DEVICE NUMBER
C          0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZKEY (TITLE - TITLE OF GRAPH,
C         XPOS - X POSITION ON THE PAGE,
C         YPOS - Y POSITION ON THE PAGE,
C         KENTRY - FIRST KEY ENTRY LABEL)
C         KEY IS POSITIONED ACCORDING TO THE UPPER RIGHT CORNER
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA PAIRS,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT AXIS MINIMUM,
C         INDMAX - INDEPENDENT AXIS MAXIMUM,
C         DEPMIN - DEPENDENT AXIS MINIMUM,
C         DEPMAX - DEPENDENT AXIS MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C

```

```

C LEZSHW
C
C LEZTRM
C
C-----
C---DATA SECTION---

      CHARACTER TITLE*80, IAXLBL*80, DAXLBL*80, LABELS*80, KENTRY*80
      REAL PI(25), SSIN(25), INDMIN, INDMAX, CCOS(25)

      WPI=ACOS(-1.)
      DO 10 I=1,25
      RI=I
      PI(I)=(RI-1.)*(WPI/12.)
      SSIN(I)=SIN(PI(I))
      CCOS(I)=COS(PI(I))
10    CONTINUE

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

      IDEV=1
      CALL LEZINI(IDEV)

C---SET UP A LINE PLOT

      NVALS=25
      TITLE='P[BLC]LOT OF TRIGONOMETRIC FUNCTIONS'
      IAXLBL='P[BLC]ERIOD IN RADIANS'
      DAXLBL='T[BLC]RIGONOMETRIC VALUES'
      INDMIN=PI(1)
      INDMAX=PI(25)
      DEPMIN=-2.0
      DEPMAX=2.0
      INDHV=1
      LINAPP=1
      CALL LEZLIN(PI, SSIN, NVALS, TITLE, IAXLBL, DAXLBL, INDMIN,
+INDMAX, DEPMIN, DEPMAX, INDHV, LINAPP)

C---CREATE A KEY---

      TITLE='K[BLC]EY OF FUNCTIONS'
      XPOS=5.25
      YPOS=6.4
      KENTRY='[BLC]Y=SIN(X)'
      CALL LEZKEY(TITLE, XPOS, YPOS, KENTRY)

C---INPUT AN ADDITIONAL DATA SET---

      NVALS=25
      IDTREL=1
      IDTAPP=1
      KENTRY='[BLC]Y=COS(X)'
      CALL LEZDAT(CCOS, NVALS, IDTREL, IDTAPP, KENTRY)

```

C---CREATE A CHARACTER AXIS---

```
IHV=1
NLABS=3
LABELS='SOS[ FONT=9][BLC]Q$2[ FONT=9][BLC]Q$'
NTMAJR=3
NTMINR=3
CALL LEZAXT(IHV,NLABS,LABELS,NTMAJR,NTMINR)
```

C---CREATE A NUMERIC AXIS---

```
IHV=2
NDEC=-1
TSTART=-2.0
TINCR=1.0
TEND=2.0
NTMINR=4
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)
```

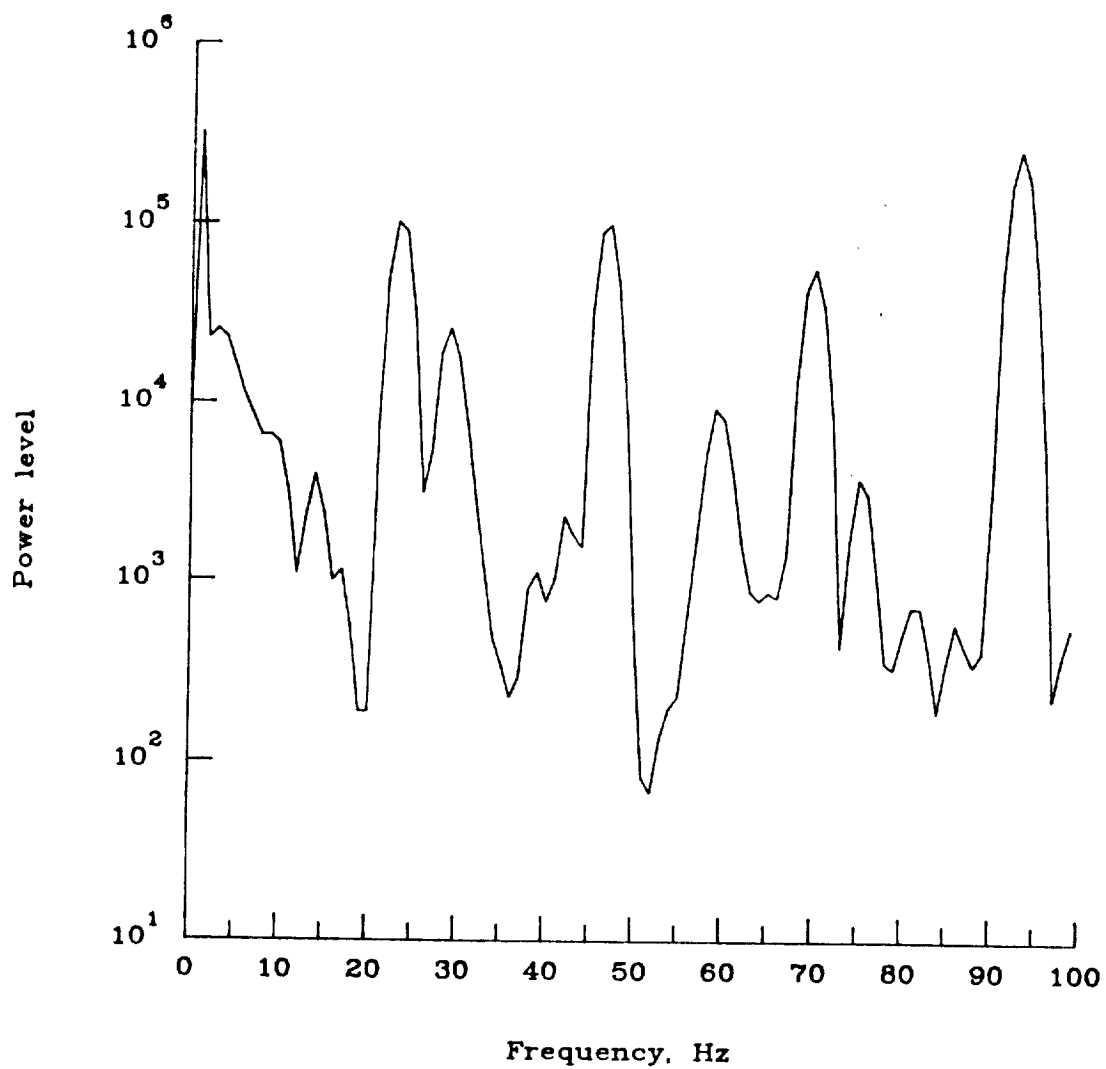
```
CALL LEZNOT('DCLIN6',7.,0.,3,1,0)
```

C---SHOW GRAPH---

```
CALL LEZSHW
```

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```
CALL LEZTRM
STOP
END
```



Power level vs. frequency

DCLOG1

PROGRAM DCLOG1

```

C-----
C
C THIS EXAMPLE DRAWS A GRAPH WITH A LOG BASE 10 AXIS
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C     NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINC - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZLOG (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT AXIS MINIMUM,
C         INDMAX - INDEPENDENT AXIS MAXIMUM,
C         DEPMIN - DEPENDENT AXIS MINIMUM,
C         DEPMAX - DEPENDENT AXIS MAXIMUM,
C         IAXTYP - DETERMINE AXIS TYPE 1:LOG IND 2:LOG DEP 3:LOG BOTH,
C         IHLOGI - HORIZONTAL AXIS TICK MARK LABEL TYPE,
C         IVLOGI - VERTICAL AXIS TICK MARK LABEL TYPE,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C
C LEZSHW
C
C LEZTRM
C-----

```

C---DATA SECTION---

```

CHARACTER TITLE*80,IAXLBL*80,DAXLBL*80,IOPT*8
LOGICAL LVALUE
REAL FREQ(100),POWER(100),INDMIN,INDMAX
DATA (POWER(I),I=1,76)/
+ 7066.0770323, 313987.5856597, 23005.34014683, 25971.13637497,
+ 23314.47811626, 16222.72126064, 11123.46224798, 8573.673551723,
+ 6533.280733426, 6567.484820724, 5931.92717933, 3100.185764845,
+ 1075.542233512, 2304.552081512, 3938.878376374, 2372.668800947,
+ 990.5827153465, 1139.692923046, 539.1035104119, 186.2399260743,
+ 185.9121866205, 6922.275564162, 47871.80671708, 101610.8109471,

```

```

+ 90151.05656181, 32565.81919631, 3126.25985372, 5378.883275207,
+ 19139.27829711, 26311.51279586, 18051.10302768, 7595.925085295,
+ 2769.064915013, 1114.906853713, 472.3435990609, 336.5553643497,
+ 224.6112529072, 292.8078714839, 913.1650006148, 1111.290988571,
+ 763.2538952391, 1036.757022708, 2318.840862193, 1815.115702427,
+ 1546.468077257, 30998.79018191, 90446.39960755, 99542.65318885,
+ 46517.56984878, 8264.407149583, 477.4873134733, 82.183079214,
+ 67.7501808438, 136.6466583528, 197.6147132091, 229.3505457034,
+ 643.2165902202, 1824.921600301, 5246.018888617, 9355.942325835,
+ 8240.202957789, 4042.516486596, 1615.454279283, 876.7523693048,
+ 780.321551955, 869.2380712535, 806.9102907816, 1417.485863451,
+ 13314.08558278, 42705.82833591, 56933.22987158, 34522.64829539,
+ 8369.70034301, 423.4410260173, 1721.308093883, 3815.021552281/
DATA (POWER(I),I=77,100)/
+ 3096.896818539, 1130.33337685, 351.6629052997, 323.9146852672,
+ 496.8216394068, 716.3789266813, 707.1830537755, 395.452882063,
+ 185.9595078555, 349.7278623283, 579.1256929328, 427.7957796537,
+ 339.4866401359, 404.7726592585, 3303.494231505, 44732.3344563,
+ 168132.2764905, 259620.2781873, 179647.069922, 51634.19154093,
+ 4701.338454798, 220.74733211, 377.2257021375, 552.6383507909/

```

```

DO 1 I=1,100
RI=I
FREQ(I)=RI-1.
1 POWER(I)=LOG10(POWER(I))

```

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

IDEV=1
CALL LEZINI(IDEV)

```

C---SET UP A LOG PLOT, INCOMING DATA HAS BEEN CONVERTED---

```

NVALS=100
TITLE='P[BLC]OWER LEVEL VS. FREQUENCY'
IAXLBL='F[BLC]REQUENCY, [ELC]H[BLC]Z'
DAXLBL='P[BLC]OWER LEVEL'
INDMIN=0.0
INDMAX=100.0
DEPMIN=LOG10(65.0)
DEPMAX=LOG10(290000.0)
IAXTYP=2
IHLOGI=0
IVLOGI=0
INDHV=1
LINAPP=1
CALL LEZLOG(FREQ,POWER,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+DEPMIN,DEPMAX,IAXTYP,IHLOGI,IVLOGI,INDHV,LINAPP)

```

C---CREATE AN INTEGER AXIS---

```

IHV=1
I3=-3
NDEC=I3

```

ORIGINAL PAGE IS
OF POOR QUALITY

```

TSTART=0.0
TINCR=10.0
TEND=100.0
NTMINR=1
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

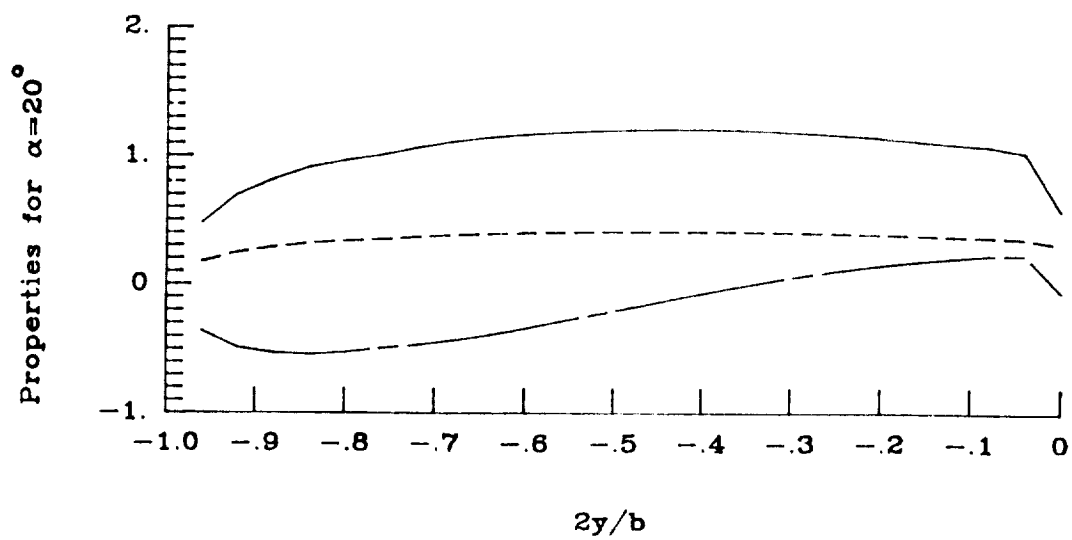
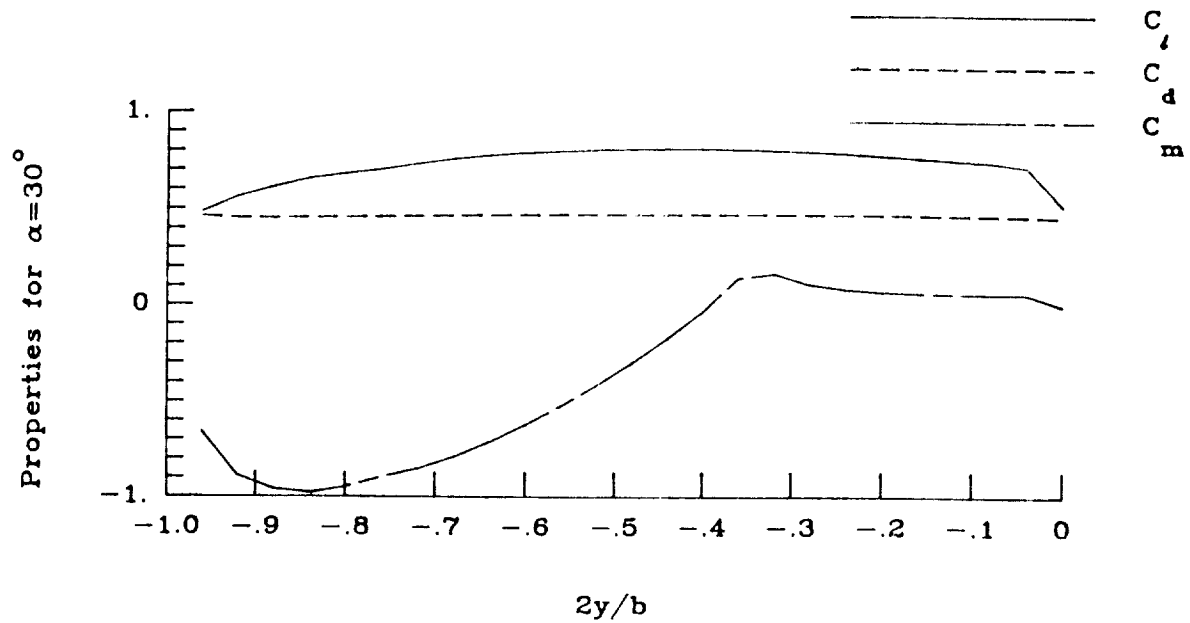
CALL LEZNOT('DCLOG1',7.,0.,3,1,0)
C---SHOW GRAPH---

CALL LEZSHW

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

CALL LEZTRM
STOP
END

```



Vortex flow about a 60° delta wing

DCMX1

PROGRAM DCMIX1

```

C-----
C THIS EXAMPLE DRAWS A MULTI-LINE GRAPH WITH AUTOSCALE HORIZONTAL AXIS.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C     NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZDAT (DEPART - ADDITIONAL DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         IDTREL - RELATIONSHIP BETWEEN DEPENDENT DATA SETS
C             1:ABSOLUTE 2:ADDITIVE,
C         IDTAPP - APPEARANCE INDICATOR
C             FOR BARS: 0:UNFILLED 1:FILLED
C             FOR LINES: 1:LINES 2:MARKERS 3:LINES AND MARKERS
C         KENTRY - KEY ENTRY LABEL FOR THIS DATA SET)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZKEY (TITLE - TITLE OF CHART,
C         XPOS - X POSITION ON THE PAGE,
C         YPOS - Y POSITION ON THE PAGE,
C         KENTRY - FIRST KEY ENTRY LABEL)
C         KEY IS POSITIONED ACCORDING TO THE UPPER RIGHT CORNER
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C         DEPART - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA PAIRS,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT AXIS MINIMUM,
C         INDMAX - INDEPENDENT AXIS MAXIMUM,
C         DEPMIN - DEPENDENT AXIS MINIMUM,
C         DEPMAX - DEPENDENT AXIS MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C
C LEZOPT (IOPT - OPTION NUMBER,
C         IVALS - OPTION VALUE(S))
C
C LEZSHW
C
C LEZTRM
C-----

```

C---VARIABLE DECLARATION AND INITIALIZATION---

```

CHARACTER TITLE*256,IAXLBL*80,DAXLBL*80,KENTRY*80
REAL SPAN(25),CLIFT(25),CDRAG(25),CMOMNT(25),INDMIN,INDMAX
DATA CLIFT/.4748,.6962,.8165,.9102,.9631,1.005,1.063,1.112,

```

```

+1.146,1.170,1.187,1.199,1.207,1.210,1.209,1.203,1.193,1.180,
+1.163,1.142,1.117,1.094,1.076,1.028,.5721/
  DATA CDRAG/.1674,.2426,.2827,.3137,.3307,.3439,.3629,.3789,
+.3897,.3971,.4021,.4056,.4077,.4084,.4076,.4054,.4020,.3975,
+.3919,.3852,.3776,.3705,.3652,.3519,.3038/
  DATA CMOMNT/-.3639,-.4936,-.5337,-.5454,-.5263,-.4971,-.4704,
+-.4348,-.3902,-.3404,-.2878,-.2336,-.1790,-.1246,-.07136,
+-.02016,.02818,.07293,.1133,.1484,.1774,.2022,.2261,.2264,-.06216/
  RI=-1.0
  DO 1 I=1,25
    RI=RI+.04
1    SPAN(I)=RI

```

C---INITIALIZE GRAPHICS, AND WRITE TO THE INTERACTIVE DEVICE---

```

  IDEV=1
  CALL LEZINI(IDEV)

```

C---ESTABLISH CHART AS A LINE CHART, AND ENTER FIRST DATA SET---
C NOTE: AUTOSCALE IS SELECTED BY SETTING INDMIN AND INDMAX TO THE
C SAME VALUE. THE SAME IS TRUE FOR DEPMIN AND DEPMAX.

```

  NVALS=25
  TITLE='V[BLC]ORTEX FLOW ABOUT A 60[BSUP]O[ESUP] DELTA WING'
  IAXLBL='[BLC]2Y/B'
  DAXLBL='P[BLC]ROPERTIES FOR [FONT=9][BLC]A[FONT]=20[BSUP]O'
C SET INDMIN AND INDMAX TO AUTOSCALE WITH INCREASING VALUES.
  INDMIN=1.
  INDMAX=1.
  DEPMIN=0.
  DEPMAX=0.
  INDHV=1
  LINAPP=1
  CALL LEZLIN(SPAN,CLIFT,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+DEPMIN,DEPMAX,INDHV,LINAPP)

```

C---ESTABLISH THE SECOND DATA SET---

```

  NVALS=25
  IDTREL=1
  LINAPP=1
  KENTRY='C[BSUB][BLC]D'
  CALL LEZDAT(CDRAG,NVALS,IDTREL,LINAPP,KENTRY)

```

C---ESTABLISH THE THIRD DATA SET---

```

  NVALS=25
  IDTREL=1
  LINAPP=1
  KENTRY='C[BSUB][BLC]M'
  CALL LEZDAT(CMOMNT,NVALS,IDTREL,LINAPP,KENTRY)

```

C---SET OPTIONS---

```

C---DO NOT CLEAR SCREEN, AND DO NOT PAUSE.
      CALL LEZOPT('PAUSE',0)
      CALL LEZOPT('CLEAR',0)
C---CHANGE VERTICAL AXIS LENGTH TO 2/3 OF HALF PAGE HEIGHT.
      VAXLEN=2.
      CALL LEZOPT('VAXLEN',VAXLEN)
C---CHANGE POSITION OF FIRST CHART.
      YORG=1.2
      CALL LEZOPT('YORIGIN',YORG)

C---SHOW CHART---
      CALL LEZSHW

C ***** SECOND CHART *****

      DO 2 I=1,25
      CDRAG(I)=CDRAG(I)-(SQRT(ABS(CDRAG(I))))+.7
      CMOMNT(I)=CMOMNT(I)-(SQRT(ABS(CMOMNT(I))))+.3
2      CLIFT(I)=CLIFT(I)-(SQRT(ABS(CLIFT(I))))+.7
C-----
C THIS EXAMPLE DRAWS A MULTI-LINE GRAPH WITH AUTOSCALE HORIZONTAL AXIS.
C NOTE, THIS EXAMPLE IS THE SAME AS CGLIN5, EXCEPT LEZLIN'S VALUES.
C THEREFORE, SEE CGLIN5 FOR DETAILS.
C-----

C---INITIALIZE GRAPHICS, AND WRITE TO THE INTERACTIVE DEVICE---

      IDEV=1
      CALL LEZINI(IDEV)

C---ESTABLISH CHART AS A LINE CHART, AND ENTER FIRST DATA SET---
C NOTE: AUTOSCALE IS SELECTED BY SETTING INDMIN AND INDMAX TO THE
C      SAME VALUE.

      NVALS=25
C NO PLOT TITLE IS NEEDED; ALREADY ONE FROM FIRST CHART.
      TITLE=' '
      IAXLBL='[BLC]2Y/B'
      DAXLBL='P[BLC]ROPERTIES FOR [FONT=9][BLC]A[FONT]=30[BSUP]O'
C SET INDMIN AND INDMAX TO AUTOSCALE WITH INCREASING VALUES.
      INDMIN=1.
      INDMAX=1.
      DEPMIN=0.
      DEPMAX=0.
      INDHV=1
      LINAPP=1
      CALL LEZLIN(SPAN,CLIFT,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+DEPMIN,DEPMAX,INDHV,LINAPP)

C---CREATE A KEY---

      TITLE=' '
      XPOS=7.0
      YPOS=6.75

```

```
KENTRY='C[BSUB][BLC][FONT=11]L'  
CALL LEZKEY(TITLE,XPOS,YPOS,KENTRY)
```

C---ESTABLISH THE SECOND DATA SET---

```
NVALS=25  
IDTREL=1  
LINAPP=1  
KENTRY='C[BSUB][BLC]D'  
CALL LEZDAT(CDRAG,NVALS,IDTREL,LINAPP,KENTRY)
```

C---ESTABLISH THE THIRD DATA SET---

```
NVALS=25  
IDTREL=1  
LINAPP=1  
KENTRY='C[BSUB][BLC]M'  
CALL LEZDAT(CMOMNT,NVALS,IDTREL,LINAPP,KENTRY)
```

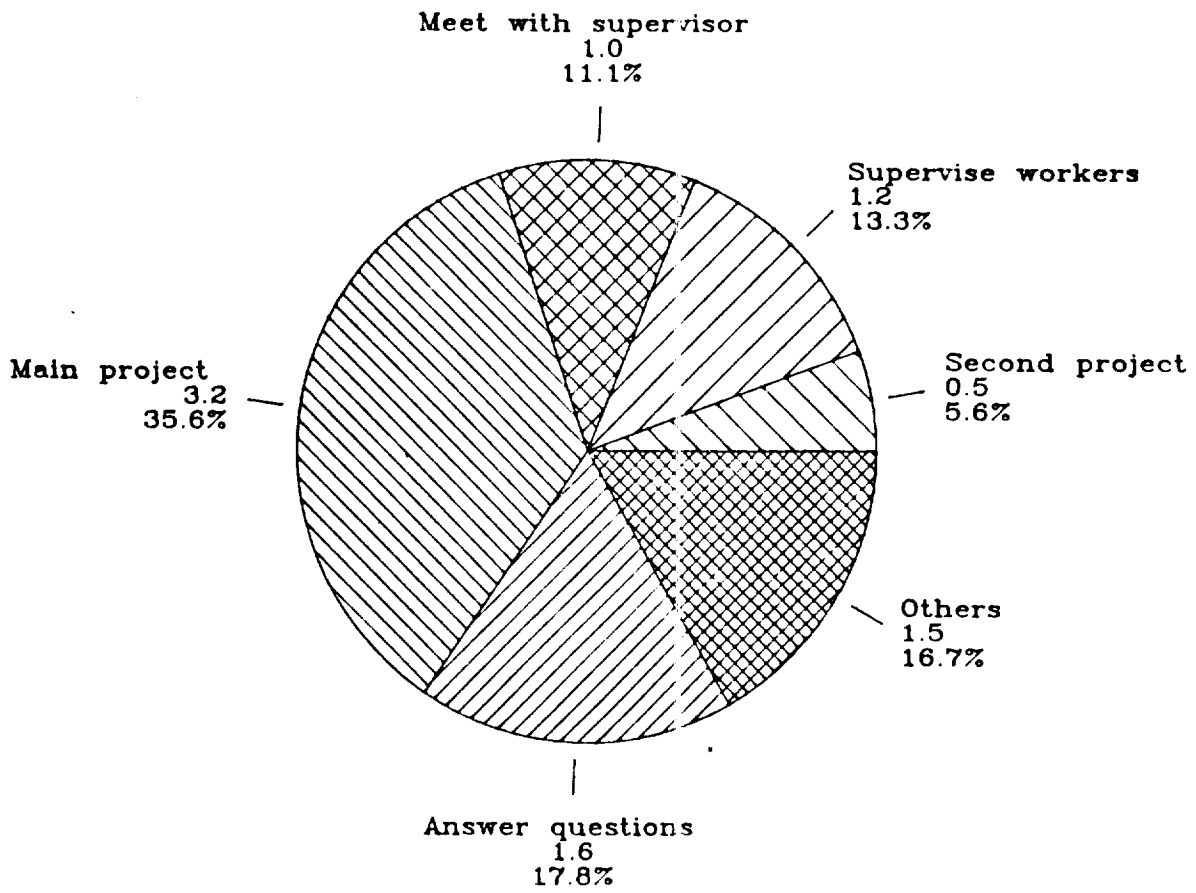
C-----

C---SET OPTIONS---

C---CHANGE VERTICAL AXIS LENGTH TO SAME AS PREVIOUS CHART.
CALL LEZOPT('VAXLEN',2.)

C---POSITION SECOND CHART
CALL LEZOPT('YORIGIN',4.0)

C---DRAW CHART, THEN TERMINATE---
CALL LEZNOT('DCMIX1',7.,0.,3,1,0)
CALL LEZSHW
CALL LEZTRM
STOP
END



Daily activities

DCPIE1

PROGRAM DCPIE1

```

C-----
C
C THIS EXAMPLE DRAWS A PIE CHART WITH QUANTITY, PERCENTAGE,
C AND SEGMENT LABELS DISPLAYED.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C          0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZPIE (SEGS - DATA SET,
C          NUM - NUMBER OF DATA VALUES,
C          TITLE - TITLE OF GRAPH,
C          NEXP1 - NUMBER OF FIRST EXPLODED SEGMENT,
C          NEXP2 - NUMBER OF LAST EXPLODED SEGMENT,
C          LFORM1 - QUANTITY LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY,
C          LFORM2 -PERCENTAGE LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY)
C
C LEZPLB (NOPLB - SEGMENT NUMBER ASSOCIATED WITH LABEL,
C          LABEL - SEGMENT LABELS,
C          KEY - KEY ENTRY LABEL FOR THIS SEGMENT)
C
C LEZSHW
C
C LEZTRM
C-----

C---DATA SECTION---

      REAL SEGS(6)

      CHARACTER*80    TITLE,    KENTRY,    LABEL,    KEY

      DATA SEGS/0.5, 1.2, 1.0, 3.2, 1.6, 1.5/

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

      IDEV = 1
      CALL LEZINI (IDEV)

C---SET UP PIE GRAPH AND LABELING---

      TITLE = 'D[BLC]AILY ACTIVITIES'
      NUM = 6
      NEXP1 = 0
      NEXP2 = 0
      LFORM1 = 1
      LFORM2 = 1
      CALL LEZPIE (SEGS,NUM,TITLE,NEXP1,NEXP2,LFORM1,LFORM2)

```

C---ASSIGN SEGEMENT LABELS---

```
NOPLB = 4
LABEL = 'M[BLC]AIN PROJECT'
KEY = ' '
CALL LEZPLB (NOPLB,LABEL,KEY)
CALL LEZPLB (1,'S[BLC]ECOND PROJECT',' ')
CALL LEZPLB (6,'O[BLC]THERS',' ')
CALL LEZPLB (2,'S[BLC]UPERVISE WORKERS',' ')
CALL LEZPLB (3,'M[BLC]EET WITH SUPERVISOR',' ')
CALL LEZPLB (5,'A[BLC]NSWER QUESTIONS',' ')
```

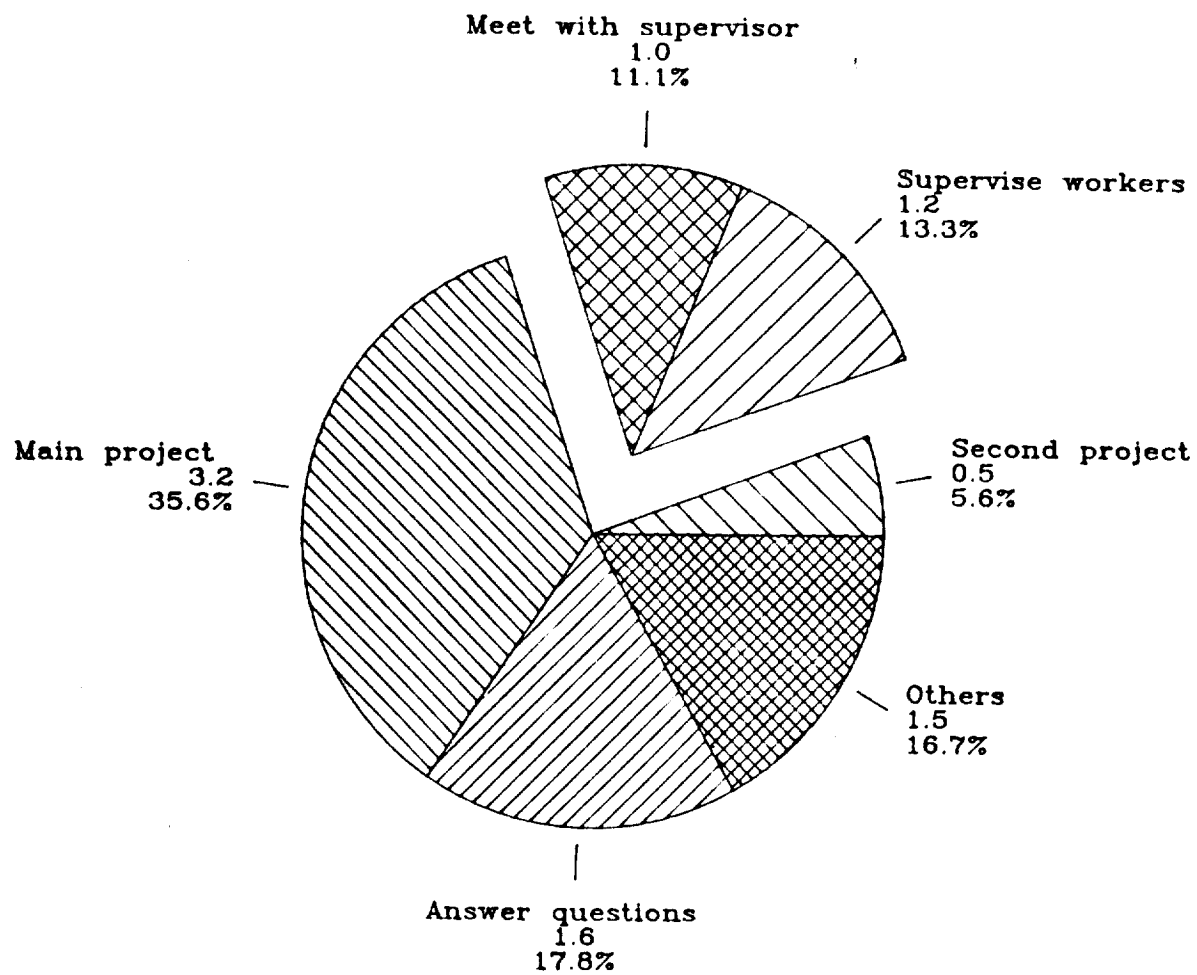
```
CALL LEZNOT('DCPIE1',7.,0.,3,1,0)
```

C---SHOW GRAPH---

```
CALL LEZSHW
```

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```
CALL LEZTRM
STOP
END
```



Daily activities

DCPIE2

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OF POOR QUALITY

PROGRAM DCPIE2

```

C-----
C
C THIS EXAMPLE DRAWS AN EXPLODED PIE CHART WITH QUANTITY, PERCENTAGE,
C AND SEGMENT LABELS DISPLAYED.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C          0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZPIE (SEGS - DATA SET,
C          NUM - NUMBER OF DATA VALUES,
C          TITLE - TITLE OF GRAPH,
C          NEXP1 - NUMBER OF FIRST EXPLODED SEGMENT,
C          NEXP2 - NUMBER OF LAST EXPLODED SEGMENT,
C          LFORM1 - QUANTITY LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY,
C          LFORM2 -PERCENTAGE LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY)
C
C LEZPLB (NOPLB - SEGMENT NUMBER ASSOCIATED WITH LABEL,
C          LABEL - SEGMENT LABELS,
C          KEY - KEY ENTRY LABEL FOR THIS SEGMENT)
C
C LEZSHW
C
C LEZTRM
C-----

```

C---DATA SECTION---

REAL SEGS(6)

CHARACTER*80 TITLE, KENTRY, LABEL, KEY

DATA SEGS/0.5, 1.2, 1.0, 3.2, 1.6, 1.5/

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

IDEV = 1

CALL LEZINI (IDEV)

C---SET UP PIE GRAPH AND LABELING---

TITLE = 'D[BLC]AILY ACTIVITIES'

NUM = 6

NEXP1 = 2

NEXP2 = 3

LFORM1 = 1

LFORM2 = 1

CALL LEZPIE (SEGS,NUM,TITLE,NEXP1,NEXP2,LFORM1,LFORM2)

C---ASSIGN SEGEMENT LABELS---

NOPLB = 4

LABEL = 'M[BLC]AIN PROJECT'

KEY = ' '

CALL LEZPLB (NOPLB,LABEL,KEY)

CALL LEZPLB (1,'S[BLC]ECOND PROJECT',' ')

CALL LEZPLB (6,'O[BLC]THERS',' ')

CALL LEZPLB (2,'S[BLC]UPERVISE WORKERS',' ')

CALL LEZPLB (3,'M[BLC]EET WITH SUPERVISOR',' ')

CALL LEZPLB (5,'A[BLC]NSWER QUESTIONS',' ')

CALL LEZNOT('DCPIE2',7.,0.,3,1,0)

C---SHOW GRAPH---

CALL LEZSHW

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---




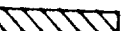


CALL LEZTRM

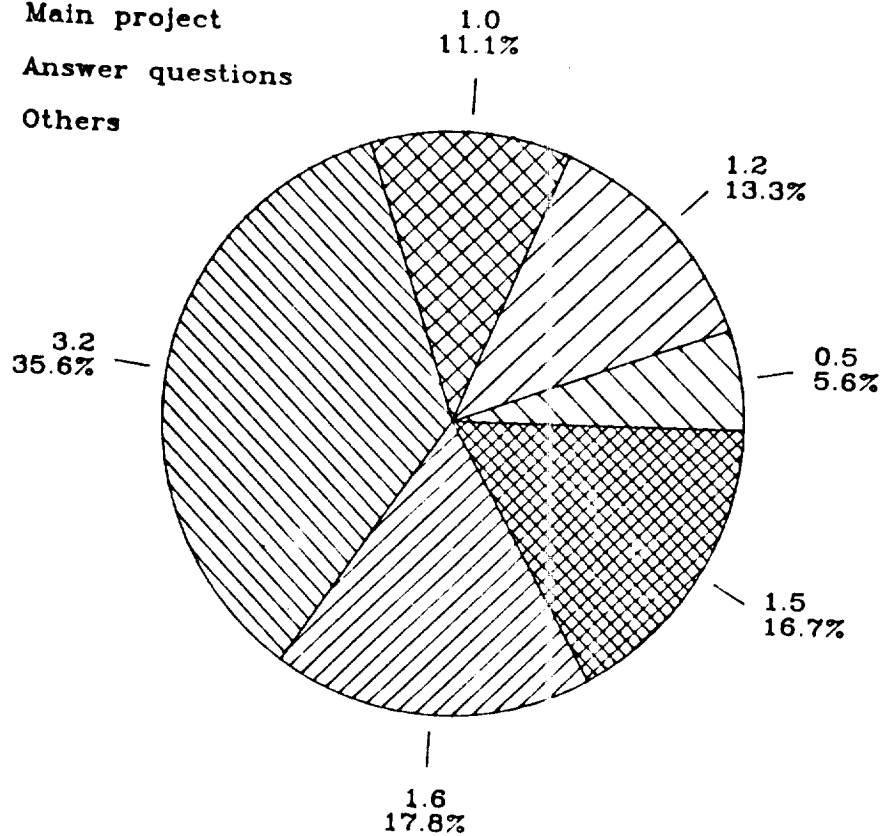
STOP

END

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OF POOR QUALITY

Present responsibilities

-  Second project
-  Supervise workers
-  Meet with supervisor
-  Main project
-  Answer questions
-  Others



Daily activities

DCPIE3

PROGRAM DCPIE3

```

C-----
C
C THIS EXAMPLE DRAWS AN PIE CHART WITH QUANTITY AND PERCENTAGE LABELS
C DISPLAYED AND WITH A KEY.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C          0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZKEY (TITLE - TITLE OF GRAPH,
C          XPOS - X POSITION ON THE PAGE,
C          YPOS - Y POSITION ON THE PAGE,
C          KENTRY - FIRST KEY ENTRY LABEL)
C          KEY IS POSITIONED ACCORDING TO THE UPPER RIGHT CORNER
C
C LEZPIE (SEGS - DATA SET,
C          NUM - NUMBER OF DATA VALUES,
C          TITLE - TITLE OF GRAPH,
C          NEXP1 - NUMBER OF FIRST EXPLODED SEGMENT,
C          NEXP2 - NUMBER OF LAST EXPLODED SEGMENT,
C          LFORM1 - QUANTITY LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY,
C          LFORM2 -PERCENTAGE LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY)
C
C LEZPLB (NOPLB - SEGMENT NUMBER ASSOCIATED WITH LABEL,
C          LABEL - SEGMENT LABELS,
C          KEY - KEY ENTRY LABEL FOR THIS SEGMENT)
C
C LEZSHW
C
C LEZTRM
C-----

```

C---DATA SECTION---

REAL SEGS(6)

CHARACTER*80 TITLE, KENTRY, LABEL, KEY

DATA SEGS/0.5, 1.2, 1.0, 3.2, 1.6, 1.5/

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

IDEV = 1

CALL LEZINI (IDEV)

C---SET UP PIE GRAPH AND LABELING---

TITLE = 'D[BLC]AILY ACTIVITIES'


```

NUM = 6
NEXP1 = 0
NEXP2 = 0
LFORM1 = 1
LFORM2 = 1
CALL LEZPIE (SEGS,NUM,TITLE,NEXP1,NEXP2,LFORM1,LFORM2)

```

C---CREATE A KEY---

```

TITLE = 'P[BLC]RESENT RESPONSIBILITIES'
XPOS = 3.3
YPOS = 7.0
KENTRY = 'S[BLC]ECOND PROJECT'
CALL LEZKEY (TITLE,XPOS,YPOS,KENTRY)

```

C---MAKE KEY ENTRIES---

```

NOPLB = 4
LABEL = ' '
KEY = 'M[BLC]AIN PROJECT'
CALL LEZPLB (NOPLB,LABEL,KEY)
CALL LEZPLB (1,' ', 'S[BLC]ECOND PROJECT')
CALL LEZPLB (6,' ', 'O[BLC]THERS')
CALL LEZPLB (2,' ', 'S[BLC]UPERVISE WORKERS')
CALL LEZPLB (3,' ', 'M[BLC]EET WITH SUPERVISOR')
CALL LEZPLB (5,' ', 'A[BLC]NSWER QUESTIONS')

```

```

CALL LEZNOT('DCPIE3',7.,0.,3,1,0)

```

C---SHOW GRAPH---

```

CALL LEZSHW

```

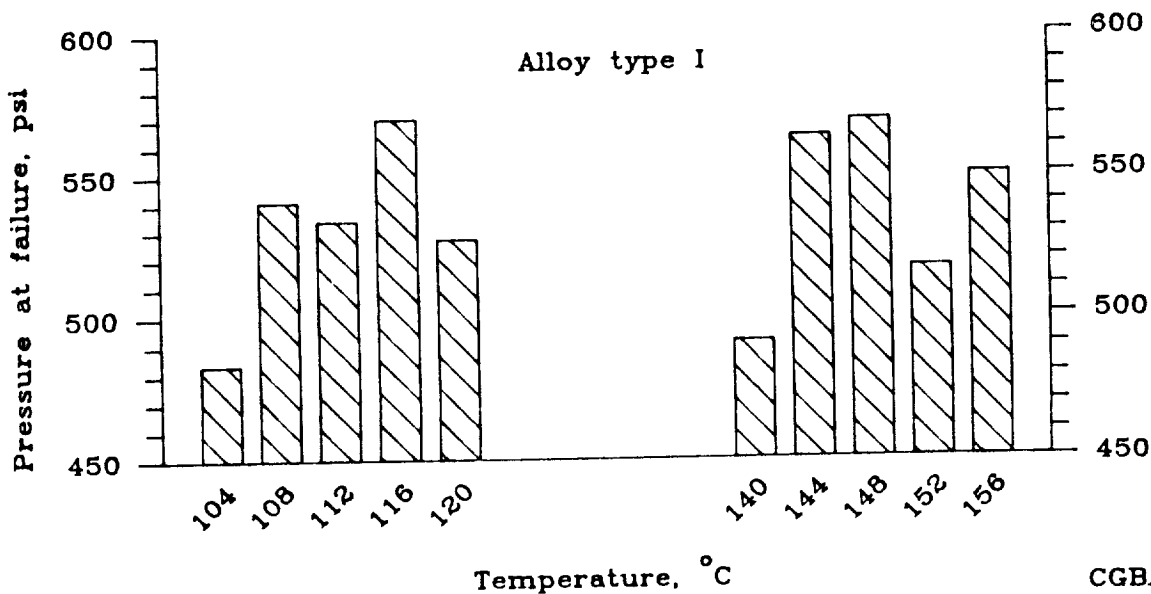
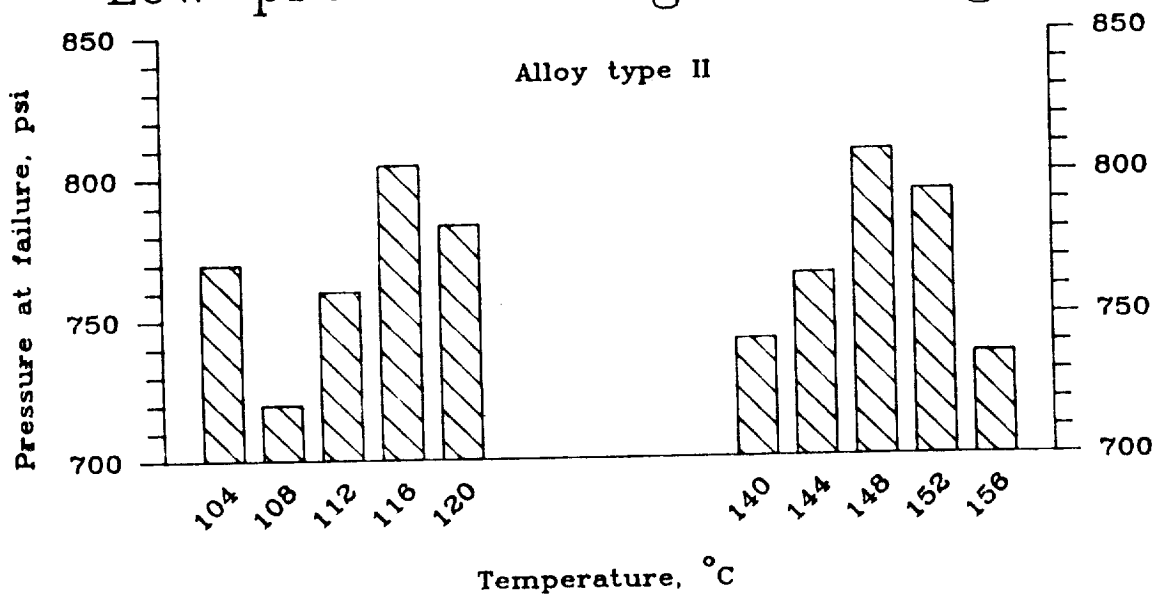
C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

CALL LEZTRM
STOP
END

```

Low pressure fatigue testing



CGBAR1

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OF POOR QUALITY

PROGRAM CGBAR1

```

C-----
C
C THIS EXAMPLE DRAWS TWO BAR GRAPHS ON ONE PAGE
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINC - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZBAR (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT DATA MINIMUM,
C         INDMAX - INDEPENDENT DATA MAXIMUM,
C         DEPMIN - DEPENDENT DATA MINIMUM,
C         DEPMAX - DEPENDENT DATA MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         IBRAPP - APPEARANCE INDICATOR 0:UNFILLED 1:FILLED)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZNOT (STRING - NOTE,
C         XPOS - X POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C         YPOS - Y POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C         IHJST - HORIZONTAL JUSTIFICATION 1:LEFT 2:CENTER 3:RIGHT,
C         IVJST - VERTICAL JUSTIFICATION 1:BOTTOM 2:CENTER 3:TOP,
C         IANG - ANGLE OF ROTATION ABOUT THE JUSTIFICATION POINT)
C         ANGLE OF ROTATION IS MEASURED COUNTERCLOCKWISE
C         FROM THE HORIZONTAL AXIS.
C
C LEZOPT (IOPT - OPTION NUMBER,
C         IVALS - OPTION VALUE(S))
C
C LEZSHW
C
C LEZSIZ (XSIZE - WIDTH OF CHARACTERS,
C         YSIZE - HEIGHT OF CHARACTERS)
C
C LEZTRM
C-----

```

```

C---DATA SECTION---

REAL INDMAX, INDMIN
REAL TEMP(10), PRES1(10), PRES2(10)

CHARACTER*80  TITLE,  IAXLBL,  DAXLBL,  STRING

DATA TEMP /104.,108.,112.,116.,120.,140.,144.,148.,152.,156./
DATA PRES1 /483.55,540.95,533.95,570.,527.3,491.25,563.35,568.95,
+          516.45,549.7/
DATA PRES2 /770.01,720.15,760.33,804.45,783.28,742.03,764.99,
+          808.03,793.68,736.29/

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

IDEV = 2
CALL LEZINI (IDEV)

C---SET UP BAR GRAPH---

NVALS = 10
TITLE = ' '
IAXLBL = 'T[BLC]EMPERATURE, [BSUP]O[ESUP][ELC]C'
DAXLBL = 'P[BLC]RESSURE AT FAILURE, PSI'
INDMIN = 100.
INDMAX = 160.
DEPMIN = 450.
DEPMAX = 600.
INDHV = 1
IBRAPP = 1
CALL LEZBAR(TEMP,PRES1,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+          DEPMIN,DEPMAX,INDHV,IBRAPP)

C---CREATE A NUMERIC AXIS---

IHV=2
NDEC=-3
TSTART=450.0
TINCR=50.
TEND=600.0
NTMINR=4
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

C---SET UP OPTIONS---

C---ROTATE HORIZONTAL TICK MARK LABELS.
CALL LEZOPT ('HTLABR',45)
C---CHANGE LENGTH OF VERTICAL AXIS.
CALL LEZOPT ('VAXLEN',2.20)
C---CHANGE Y COORDINATE OF ORIGIN.
CALL LEZOPT ('YORIGIN',.75)
C---CHANGE TICK MARK POSITIONING ON VERTICAL AXIS;  OUTSIDE DATA SPACE.
CALL LEZOPT ('VTICPOS',2)
C---SET FLAG TO NOT CLEAR SCREEN AFTER LEZSHW.

```

```

      CALL LEZOPT ('CLEAR',.FALSE.)
C---SET FLAG TO NOT PAUSE AFTER LEZSHW.
      CALL LEZOPT ('PAUSE',.FALSE.)
C---SET FLAG TO DRAW RIGHT SIDE AXIS.
      CALL LEZOPT ('RTAXIS',.TRUE.)

C---TITLE FOR FIRST GRAPH---

      STRING = 'A[BLC]LLOY TYPE [ELC]I'
      XPOS = 4.0
      YPOS = 2.8
      IHJST = 2
      IVJST = 2
      IANG = 0
      CALL LEZNOT(STRING,XPOS,YPOS, IHJST,IVJST,IANG)

      CALL LEZNOT('CGBAR1',7.,0.,3.,0)
C---SHOW FIRST GRAPH---

      CALL LEZSHW

C---SET UP SECOND BAR GRAPH---

      NVALS = 10
      TITLE = ' '
      IAXLBL = 'T[BLC]EMPERATURE, [BSUP]O[ESUP][ELC]C'
      DAXLBL = 'P[BLC]RESSURE AT FAILURE, PSI'
      NVALS = 10
      INDMIN = 100.
      INDMAX = 160.
      DEPMIN = 700.
      DEPMAX = 850.
      INDHV = 1
      IBRAPP = 1
      CALL LEZBAR(TEMP,PRES2,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+               DEPMIN,DEPMAX,INDHV,IBRAPP)

C---CREATE A NUMERIC AXIS---

      IHV=2
      NDEC=-3
      TSTART=700.0
      TINCR=50.
      TEND=850.0
      NTMINR=4
      CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

C---SET OPTIONS FOR SECOND GRAPH---

C---CHANGE Y COORDINATE OF ORIGIN.
      CALL LEZOPT ('YORIGIN',4.0)
C---CHANGE LENGTH OF VERTICAL AXIS.
      CALL LEZOPT ('VAXLEN',2.20)
C---SET FLAG TO PAUSE AFTER LEZSHW.

```

```

CALL LEZOPT ('PAUSE',.TRUE.)

C---TITLE FOR SECOND CHART---

STRING = 'A[BLC]LLOY TYPE [ELC]II'
XPOS = 4.0
YPOS = 6.0
IHJST = 2
IVJST = 2
IANG = 0
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

C---CHANGE CHARACTER SIZE OF TEXT FOR NOTE---

XSIZE = 0.2
YSIZE = 0.35
CALL LEZSIZ (XSIZE,YSIZE)

C---PUT NOTE ON PAGE---

STRING = 'L[BLC]OW PRESSURE FATIGUE TESTING'
XPOS = 3.9
YPOS = 6.5
IHJST = 2
IVJST = 2
IANG = 0
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

C---CHANGE CHARACTER SIZE OF TEXT BACK TO DEFAULT SIZE---

XSIZE = 0.0
YSIZE = 0.0
CALL LEZSIZ (XSIZE,YSIZE)

C---SHOW GRAPH---

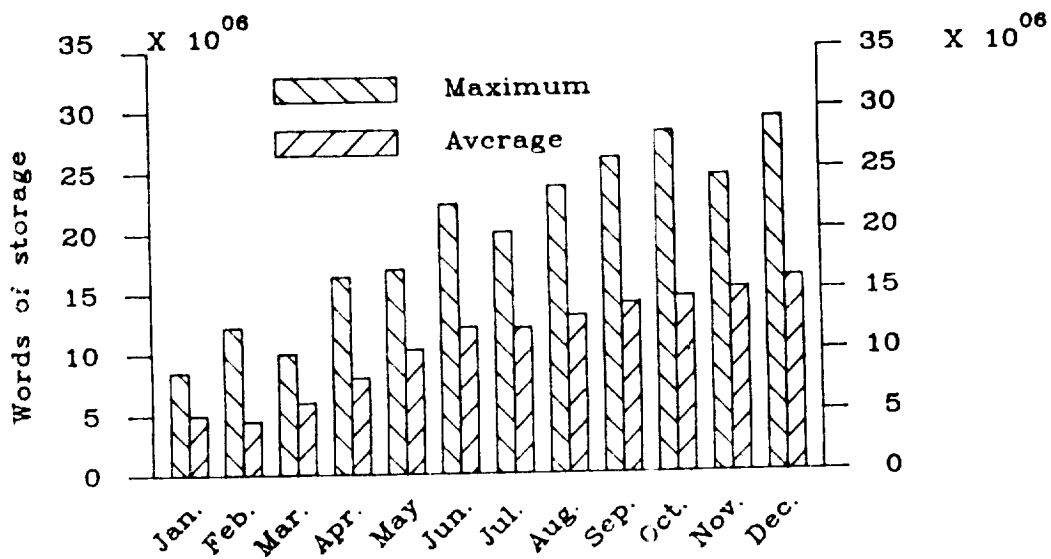
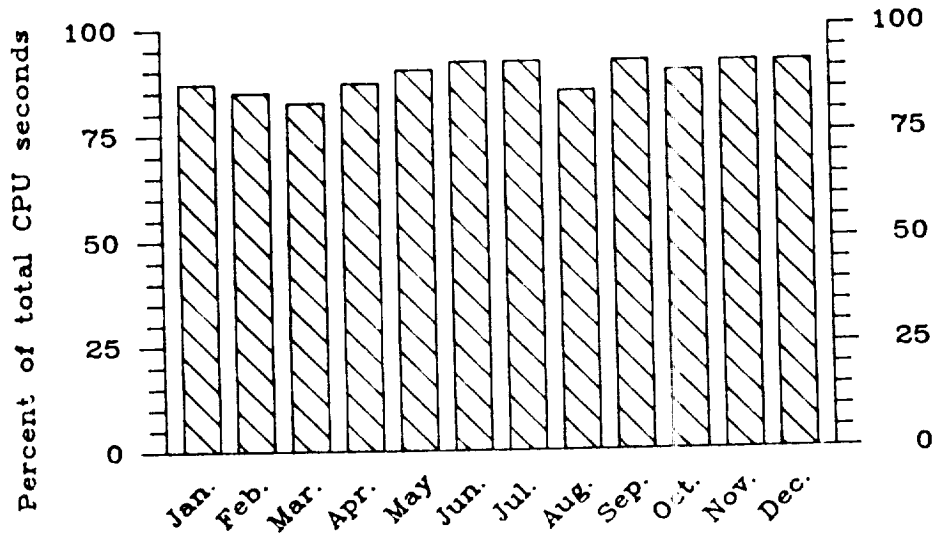
CALL LEZSHW

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

CALL LEZTRM
STOP
END

```

Computer Q4B utilization 1972



CGBAR2

PROGRAM CGBAR2

```

C-----
C
C THIS EXAMPLE DRAWS TWO BAR GRAPHS ON ONE PAGE
C ONE GRAPH HAS A KEY
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINC - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZAXS (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINC - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         IEXP - POWER OF TEN TO BE USED,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZDAT (DEPART - ADDITIONAL DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         IDTREL - RELATIONSHIP BETWEEN DEPENDENT DATA SETS
C                 1:ABSOLUTE 2:ADDITIVE,
C         IDTAPP - APPEARANCE INDICATOR 0:UNFILLED 1:FILLED,
C         KENTRY - KEY ENTRY LABEL FOR THIS DATA SET)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZKEY (TITLE - TITLE OF GRAPH,
C         XPOS - X POSITION ON THE PAGE,
C         YPOS - Y POSITION ON THE PAGE,
C         KENTRY - FIRST KEY ENTRY LABEL)
C         KEY IS POSITIONED ACCORDING TO THE UPPER RIGHT CORNER
C
C LEZLBR (VALUES - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         TITLE - TITLE OF GRAPH,
C         LABELS - TICK MARK LABELS,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         VALMIN - DEPENDENT DATA MINIMUM,
C         VALMAX - DEPENDENT DATA MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         IBRAPP - APPEARANCE INDICATOR 0:UNFILLED 1:FILLED)
C
C LEZNOT (STRING - NOTE,
C         XPOS - X POSITION OF THE JUSTIFICATION POINT ON THE PAGE,

```



```

C      YPOS - Y POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C      IHJST - HORIZONTAL JUSTIFICATION 1:LEFT 2:CENTER 3:RIGHT,
C      IVJST - VERTICAL JUSTIFICATION 1:BOTTOM 2:CENTER 3:TOP,
C      IANG - ANGLE OF ROTATION ABOUT THE JUSTIFICATION POINT)
C      ANGLE OF ROTATION IS MEASURED COUNTERCLOCKWISE
C      FROM THE HORIZONTAL AXIS.

```

```

C      LEZOPT (IOPT - OPTION NUMBER,
C              IVALS - OPTION VALUE(S))
C
C      LEZSHW
C
C      LEZSIZ (XSIZE - WIDTH OF CHARACTERS
C              YSIZE - HEIGHT OF CHARACTERS)
C
C      LEZTRM
C
C-----

```

C---DATA SECTION---

```

      REAL CPU(12), AVGMEM(12), MAXMEM(12)

      CHARACTER*256 TITLE, KENTRY, IAXLBL, STRING, DAXLBL, LABELS

      DATA CPU /87.,84.9,82.5,87.,90.1,92.,92.,85.,92.,89.5,91.7,91.6/
      DATA AVGMEM /5.,4.5,6.,8.,10.3,12.1,12.,13.,14.,14.5,15.2,16.1/
      DATA MAXMEM /8.5,12.2,10.,16.4,17.,22.3,20.,23.7,26.,28.1,
+                24.5,29.2/

      DO 1 I=1,12
        MAXMEM(I)=MAXMEM(I)*(10.**6)
        AVGMEM(I)=AVGMEM(I)*(10.**6)
1      CONTINUE

```

C---INITILIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

      IDEV = 1
      CALL LEZINI (IDEV)

```

C---SET UP LABELED BAR GRAPH---

```

      NVALS = 12
      TITLE = ' '
      LABELS = '$J[BLC]AN.$F[BLC]EB.$M[BLC]AR.$A[BLC]PR.$M[BLC]AY$J[BLC]
+UN.$J[BLC]UL.$A[BLC]UG.$S[BLC]EP.$O[BLC]CT.$N[BLC]OV.$D[BLC]EC.$'
      IAXLBL = ' '
      DAXLBL = 'P[BLC]ERCENT OF TOTAL [BUC]CPU[BLC] SECONDS'
      VALMIN = 0.
      VALMAX = 100.
      INDHV = 1
      IBRAPP = 1
      CALL LEZLBR (CPU,NVALS,TITLE,LABELS,IAXLBL,DAXLBL,VALMIN,VALMAX,
+                INDHV,IBRAPP)

```

C---CREATE A NUMERIC AXIS---

```
IHV=2
NDEC=-3
TSTART=0.0
TINCR=25.0
TEND=100.0
NTMINR=4
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)
```

C---SET UP OPTIONS---

```
C---CHANGE LENGTH OF HORIZONTAL AXIS.
      CALL LEZOPT ('HAXLEN',3.5)
C---CHANGE LENGTH OF VERTICAL AXIS.
      CALL LEZOPT ('VAXLEN',2.20)
C---SET FLAG TO DRAW RIGHT SIDE AXIS.
      CALL LEZOPT ('RTAXIS',.TRUE.)
C---CHANGE Y COORDINATE OF ORIGIN.
      CALL LEZOPT ('YORIGIN',3.8)
C---SET FLAG TO NOT CLEAR SCREEN AFTER LEZSHW.
      CALL LEZOPT ('CLEAR',.FALSE.)
C---SET FLAG TO NOT PAUSE AFTER LEZSHW.
      CALL LEZOPT ('PAUSE',.FALSE.)
C---CHANGE TICK MARK POSITIONING ON VERTICAL AXIS;  OUTSIDE DATA SPACE.
      CALL LEZOPT ('VTICPOS',2)
C---ROTATE TICK MARK LABELS ON HORIZONTAL AXIS.
      CALL LEZOPT ('HTLABR',45)

      CALL LEZNOT('CGBAR2',7.,0.,3,1,0)
C---SHOW FIRST CHART---
```

CALL LEZSHW

C---SET UP SECOND LABELED BAR CHART---

```
NVALS = 12
TITLE = ' '
LABELS = '$JAN$FEB$MAR$APR$MAY$JUN$JUL$AUG$SEP$OCT$NOV$DEC$'
IAXLBL = ' '
DAXLBL = 'W[BLC]ORDS OF STORAGE'
VALMIN = 0.
VALMAX = 35.*(10.**6)
INDHV = 1
IBRAPP = 1
CALL LEZLBR (MAXMEM,NVALS,TITLE,LABELS,IAXLBL,DAXLBL,VALMIN,
+           VALMAX,INDHV,IBRAPP)
```

C---SET UP KEY---

```
TITLE = ' '
XPOS = 4.0
YPOS = 3.0
```

```

        KENTRY = 'M[BLC]AXIMUM'
        CALL LEZKEY (TITLE,XPOS,YPOS,KENTRY)

C---CREATE AN AXIS WITH SCIENTIFIC NOTATION---

        IHV=2
        TSTART=0.0
        TINCR=5.*(10.**6)
        TEND=35.0*(10.**6)
        IEXP=6
        NTMINR=0
        CALL LEZAXS(IHV,TSTART,TINCR,TEND,IEXP,NTMINR)

C---ADD ADDITIONAL DATA SET---

        NVALS = 12
        IDTREL = 1
        IDTAPP = 1
        KENTRY = 'A[BLC]VERAGE'
        CALL LEZDAT (AVGMEM,NVALS,IDTREL,IDTAPP,KENTRY)

C---SET UP OPTIONS FOR SECOND GRAPH---

C---CHANGE Y COORDINATE OF ORIGIN.
        CALL LEZOPT ('YORIGIN',.75)
C---SET FLAG TO PAUSE AFTER LEZSHW.
        CALL LEZOPT ('PAUSE',.TRUE.)

C---CHANGE CHARACTER SIZE OF TEXT FOR NOTE---

        XSIZE = 0.25
        YSIZE = 0.25/.8
        CALL LEZSIZ (XSIZE,YSIZE)

C---PUT NOTE ON PAGE---

        STRING = 'C[BLC]OMPUTER [ELC]Q4B [BLC]UTILIZATION 1972'
        XPOS = 3.9
        YPOS = 6.8
        IHJST = 2
        IVJST = 2
        IANG = 0
        CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

C---CHANGE CHARACTER SIZE OF TEXT BACK TO DEFAULT SIZE---

        XSIZE = 0.0
        YSIZE = 0.0
        CALL LEZSIZ (XSIZE,YSIZE)

C---SHOW GRAPH---

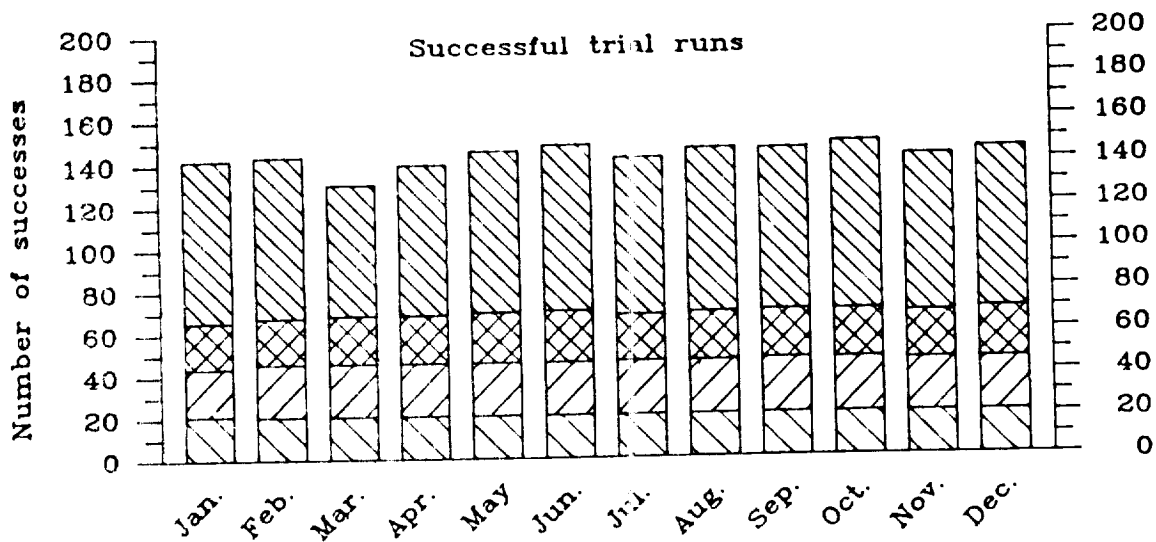
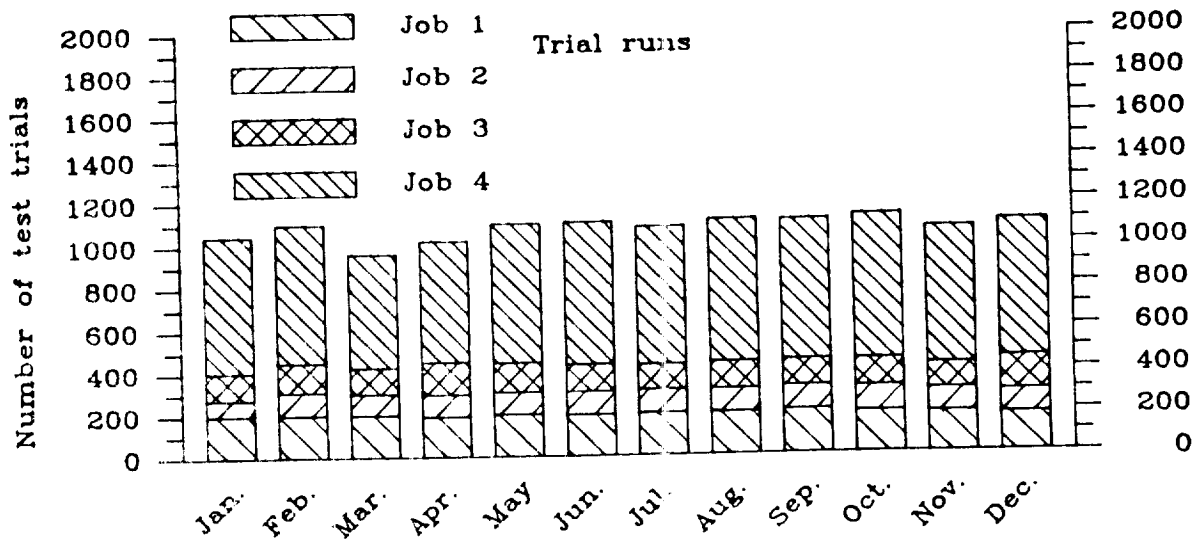
        CALL LEZSHW

```

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

CALL LEZTRM
STOP
END

Progress of test cases



CGBAR3

ORIGINAL PAGE IS
OF POOR QUALITY

PROGRAM CGBAR3

```

C-----
C
C THIS EXAMPLE DRAWS TWO BAR GRAPHS ON ONE PAGE WITH ONE LEGEND
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINC - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZDAT (DEPARY - ADDITIONAL DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         IDTREL - RELATIONSHIP BETWEEN DEPENDENT DATA SETS
C                 1:ABSOLUTE 2:ADDITIVE,
C         IDTAPP - APPEARANCE INDICATOR 0:UNFILLED 1:FILLED,
C         KENTRY - KEY ENTRY LABEL FOR THIS DATA SET)
C
C LEZINI (IDDEV - DI-3000 LOGICAL DEVICE NUMBER
C           0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZKEY (TITLE - TITLE OF GRAPH,
C         XPOS - X POSITION ON THE PAGE,
C         YPOS - Y POSITION ON THE PAGE,
C         KENTRY - FIRST KEY ENTRY LABEL)
C         KEY IS POSITIONED ACCORDING TO THE UPPER RIGHT CORNER
C
C LEZLBR (VALUES - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         TITLE - TITLE OF GRAPH,
C         LABELS - TICK MARK LABELS,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         VALMIN - DEPENDENT DATA MINIMUM,
C         VALMAX - DEPENDENT DATA MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         IBRAPP - APPEARANCE INDICATOR 0:UNFILLED 1:FILLED)
C
C LEZNOT (STRING - NOTE,
C         XPOS - X POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C         YPOS - Y POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C         IHJST - HORIZONTAL JUSTIFICATION 1:LEFT 2:CENTER 3:RIGHT,
C         IVJST - VERTICAL JUSTIFICATION 1:BOTTOM 2:CENTER 3:TOP,
C         IANG - ANGLE OF ROTATION ABOUT THE JUSTIFICATION POINT)
C         ANGLE OF ROTATION IS MEASURED COUNTERCLOCKWISE
C         FROM THE HORIZONTAL AXIS.
C
C LEZOPT (IOPT - OPTION NUMBER,

```

C IVALS - OPTION VALUE(S))
C
C LEZSHW
C
C LEZSIZ (XSIZE - WIDTH OF CHARACTERS,
C YSIZE - HEIGHT OF CHARACTERS)
C
C LEZTRM
C
C-----

C---DATA SECTION---

REAL JOB1(12),JOB2(12),JOB4(12),JOB3(12)
REAL JOB1A(12),JOB2A(12),JOB3A(12),JOB4A(12)

CHARACTER*80 KENTRY, TITLE, IAXLBL, DAXLBL, STRING
CHARACTER*256 LABELS

DATA JOB1 /2.,2.,2.,1.9,2.,1.95,2.,2.,2.07,1.95,1.9,1.8/
DATA JOB2 /.75,1.1,1.,1.05,1.05,1.1,1.1,1.1,1.13,1.2,1.1,1.1/
DATA JOB4 /6.4,6.5,5.35,5.7,6.55,6.7,6.5,6.7,6.6,6.8,6.45,6.45/
DATA JOB3 /1.3,1.4,1.25,1.55,1.4,1.3,1.2,1.3,1.25,1.3,1.2,1.6/

DATA JOB1A /21.,20.5,20.5,20.5,20.5,20.5,20.5,20.5,20.5,20.5,
+ 20.5,20.5/
DATA JOB2A /2.25,2.49,2.49,2.5,2.51,2.51,2.55,2.55,2.6,2.58,
+ 2.5,2.5/
DATA JOB3A /2.2,2.2,2.3,2.3,2.4,2.45,2.2,2.3,2.3,2.3,2.25,2.4/
DATA JOB4A /7.65,7.6,6.2,7.1,7.6,7.8,7.4,7.7,7.6,7.9,7.4,7.55/

DO 1 I=1,12
 JOB1(I)=JOB1(I)*100.
 JOB2(I)=JOB2(I)*100.
 JOB3(I)=JOB3(I)*100.
 JOB4(I)=JOB4(I)*100.
 JOB2A(I)=JOB2A(I)*10.
 JOB3A(I)=JOB3A(I)*10.
 JOB4A(I)=JOB4A(I)*10.

1 CONTINUE

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

IDEV = 2
CALL LEZINI (IDEV)

C---SET UP LABELED BAR GRAPH---

NVALS = 12
TITLE = '
LABELS = '\$J[BLC]AN.\$F[BLC]EB.\$M[BLC]AR.\$A[BLC]PR.\$M[BLC]AY\$J[BLC]
+UN.\$J[BLC]UL.\$A[BLC]UG.\$S[BLC]EP.\$O[BLC]CT.\$N[BLC]OV.\$D[BLC]EC.\$'
IAXLBL = '
DAXLBL = 'N[BLC]UMBER OF TEST TRIALS'

```

        VALMIN = 0.
        VALMAX = 2000.
        INDHV = 1
        IBRAPP = 1
        CALL LEZLBR (JOB1,NVALS,TITLE,LABELS,IAXLBL,DAXLBL,VALMIN,
+                  VALMAX,INDHV,IBRAPP)

```

C---CREATE A NUMERIC AXIS---

```

        IHV=2
        NDEC=-3
        TSTART=0.0
        TINCR=200.0
        TEND=2000.0
        NTMINR=1
        CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

```

C---INPUT NEW DATA SETS---

```

        NVALS = 12
        IDTREL = 2
        IDTAPP = 1
        KENTRY = ' '
        CALL LEZDAT (JOB2,NVALS,IDTREL,IDTAPP,KENTRY)
        CALL LEZDAT (JOB3,12,2,1,' ')
        CALL LEZDAT (JOB4,12,2,1,' ')

```

C---SET UP OPTIONS FOR FIRST GRAPH---

```

C---ROTATE TICK MARK LABELS ON HORIZONTAL AXIS.
        CALL LEZOPT ('HTLABR',45)
C---SET FLAG TO DRAW RIGHT SIDE VERTICAL AXIS.
        CALL LEZOPT ('RTAXIS',.TRUE.)
C---CHANGE LENGTH OF VERTICAL AXIS.
        CALL LEZOPT ('VAXLEN',2.20)
C---CHANGE Y COORDINATE OF ORIGIN.
        CALL LEZOPT ('YORIGIN',4.0)
C---SET FLAG TO NOT CLEAR SCREEN AFTER LEZSHW.
        CALL LEZOPT ('CLEAR',.FALSE.)
C---SET FLAG TO NOT PAUSE AFTER LEZSHW.
        CALL LEZOPT ('PAUSE',.FALSE.)
C---CHANGE TICK MARK POSITIONING ON VERTICAL AXIS;  OUTSIDE DATA SPACE.
        CALL LEZOPT ('VTICPOS',2)

```

C---TITLE OF FIRST CHART---

```

        STRING = 'T[BLC]RIAL RUNS'
        XPOS = 3.9
        YPOS = 6.20
        IHJST = 2
        IVJST = 3
        IANG = 0
        CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

```

ORIGINAL PAGE IS
OF POOR QUALITY


```

      CALL LEZNOT('CGBAR3',7.,0.,3,1,0)
C---SHOW FIRST GRAPH---

      CALL LEZSHW

C---SET UP SECOND BAR GRAPH---

      NVALS = 12
      TITLE = '
      LABELS = '$J[BLC]AN.$F[BLC]EB.$M[BLC]AR.$A[BLC]PR.$M[BLC]AY$J[BLC]
+UN.$J[BLC]UL.$A[BLC]UG.$S[BLC]EP.$O[BLC]CT.$N[BLC]OV.$D[BLC]EC.$
      IAXLBL = '
      DAXLBL = 'N[BLC]UMBER OF SUCCESSIS'
      VALMIN = 0.
      VALMAX = 200.
      INDHV = 1
      IBRAPP = 1
      CALL LEZLBR (JOB1A,NVALS,TITLE,LABELS,IAXLBL,DAXLBL,VALMIN,
+                VALMAX,INDHV,IBRAPP)

C---CREATE A NUMERIC AXIS---

      IHV=2
      NDEC=-2
      TSTART=0.0
      TINC=20.0
      TEND=200.0
      NTMINR=1
      CALL LEZAXN(IHV,NDEC,TSTART,TINC,TEND,NTMINR)

C---CREATE KEY---

      TITLE = '
      XPOS = 3.4
      YPOS = 6.5
      KENTRY = 'J[BLC]OB 1'
      CALL LEZKEY (TITLE,XPOS,YPOS,KENTRY)

C---INPUT NEW DATA SETS---

      NVALS = 12
      IDTREL = 2
      IDTAPP = 1
      KENTRY = 'J[BLC]OB 2'
      CALL LEZDAT (JOB2A,NVALS,IDTREL,IDTAPP,KENTRY)
      CALL LEZDAT (JOB3A,12,2,1,'J[BLC]OB 3')
      CALL LEZDAT (JOB4A,12,2,1,'J[BLC]OB 4')

C---SET OPTIONS FOR SECOND GRAPH---

C---CHANGE Y COORDINATE OF ORIGIN.
      CALL LEZOPT ('YORIGIN',.75)
C---SET FLAG TO PAUSE AFTER LEZSHW.
      CALL LEZOPT ('PAUSE',.TRUE.)

```

C---TITLE OF SECOND CHART---

```
STRING = 'S[BLC]UCCESSFUL TRIAL RUNS'  
XPOS = 3.9  
YPOS = 2.95  
IHJST = 2  
IVJST = 3  
IANG = 0  
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)
```

C---CHANGE CHARACTER SIZE OF TEXT FOR NOTE---

```
XSIZE = 0.25  
YSIZE = 0.25/.8  
CALL LEZSIZ (XSIZE,YSIZE)
```

C---PUT NOTE ON PAGE---

```
STRING = 'P[BLC]ROGRESS OF TEST CASES'  
XPOS = 3.9  
YPOS = 6.7  
IHJST = 2  
IVJST = 2  
IANG = 0  
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)
```

C---CHANGE CHARACTER SIZE OF TEXT BACK TO DEFAULT SIZE---

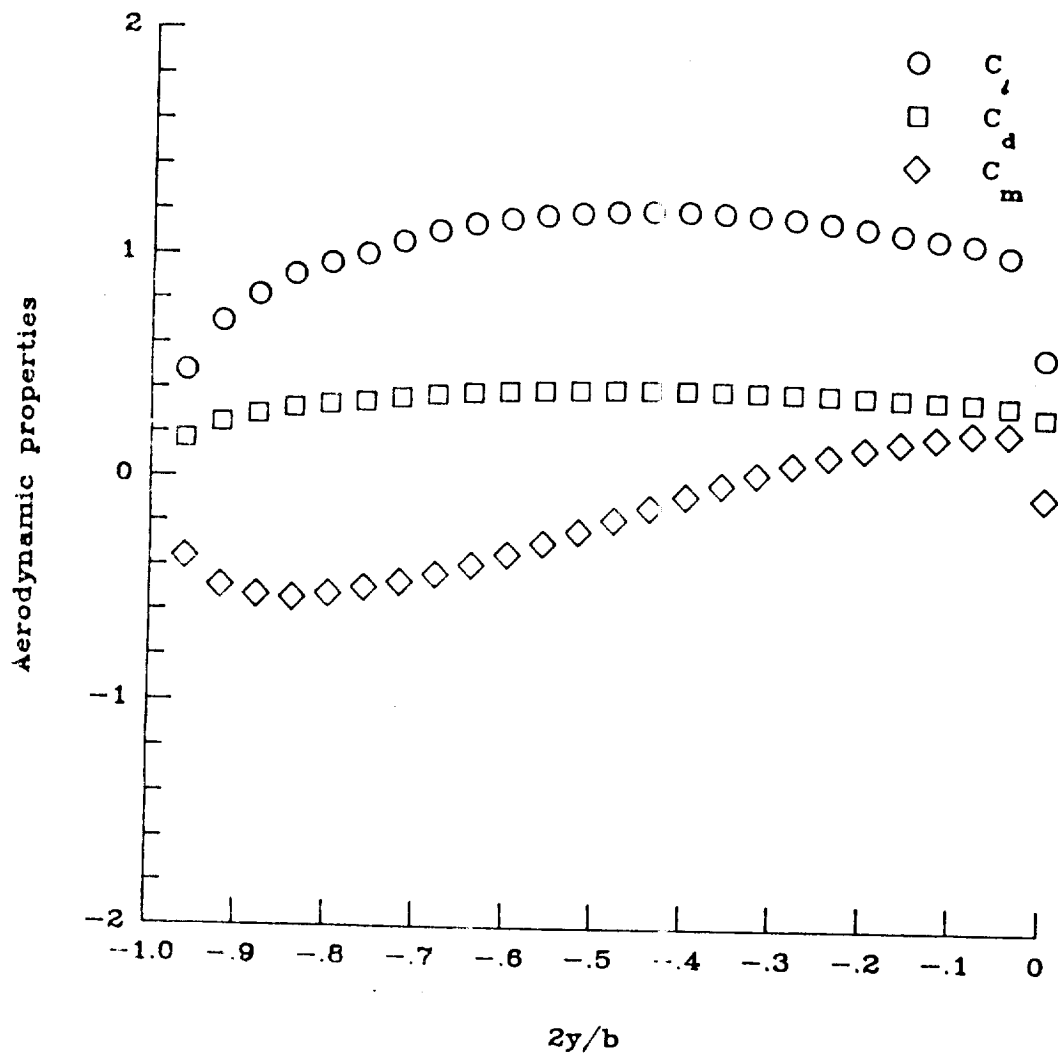
```
XSIZE = 0.0  
YSIZE = 0.0  
CALL LEZSIZ (XSIZE,YSIZE)
```

C---SHOW GRAPH---

```
CALL LEZSHW
```

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```
CALL LEZTRM  
STOP  
END
```



Vortex flow about a 60° delta wing with $\alpha=20^\circ$

CGLIN1

PROGRAM CGLIN1

```

C-----
C
C THIS EXAMPLE DRAWS A MULTI-LINE CHART WITH AN AUTOSCALED HORIZONTAL
C AXIS. THE COMMENTS IN THIS PROGRAM EMPHASIZE AUTOSCALED AXES.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHW - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C TSTART - FIRST MAJOR TICK MARK VALUE,
C TINC - MAJOR TICK MARK INCREMENT,
C TEND - LAST MAJOR TICK MARK VALUE,
C NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZDAT (DEPARY - ADDITIONAL DEPENDENT DATA SET,
C NVALS - NUMBER OF DATA VALUES,
C DTREL - RELATIONSHIP BETWEEN DEPENDENT DATA SETS
C 1:ABSOLUTE 2:ADDITIVE,
C DATAPP - APPEARANCE INDICATOR
C FOR BARS: 0:UNFILLED 1:FILLED
C FOR LINES: 1:LINES 2:MARKERS 3:BOTH,
C KENTRY - KEY ENTRY LABEL FOR THIS DATA SET)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C 0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZKEY (TITLE - TITLE OF CHART,
C XPOS - X POSITION ON THE PAGE,
C YPOS - Y POSITION ON THE PAGE,
C KENTRY - FIRST KEY ENTRY LABEL)
C KEY IS POSITIONED ACCORDING TO THE UPPER RIGHT CORNER
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C DEPARY - DEPENDENT DATA SET,
C NVALS - NUMBER OF DATA PAIRS,
C TITLE - TITLE OF CHART,
C IAXLBL - INDEPENDENT AXIS LABEL,
C DAXLBL - DEPENDENT AXIS LABEL,
C INDMIN - INDEPENDENT AXIS MINIMUM,
C INDMAX - INDEPENDENT AXIS MAXIMUM,
C DEPMIN - DEPENDENT AXIS MINIMUM,
C DEPMAX - DEPENDENT AXIS MAXIMUM,
C INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C
C LEZSHW
C
C LEZTRM
C-----

```

C---VARIABLE DECLARATION AND INITIALIZATION---

```

      CHARACTER TITLE*256, IAXLBL*80, DAXLBL*80, KENTRY*80
      REAL SPAN(25), CLIFT(25), CDRAG(25), CMOMNT(25), INDMIN, INDMAX
      DATA CLIFT/.4748, .6962, .8165, .9302, .9631, 1.005, 1.063, 1.112,
+1.146, 1.170, 1.187, 1.199, 1.207, 1.210, 1.209, 1.203, 1.193, 1.180,
+1.163, 1.142, 1.117, 1.094, 1.076, 1.028, .5721/
      DATA CDRAG/.1674, .2426, .2827, .3137, .3307, .3439, .3629, .3789,
+ .3897, .3971, .4021, .4056, .4077, .4084, .4076, .4054, .4020, .3975,
+ .3919, .3852, .3776, .3705, .3652, .3519, .3038/
      DATA CMOMNT/-.3639, -.4936, -.5337, -.5454, -.5263, -.4971, -.4704,
+ -.4348, -.3902, -.3404, -.2878, -.2336, -.1790, -.1246, -.07136,
+ -.02016, .02818, .07293, .1133, .1484, .1774, .2022, .2261, .2264, -.06216/
      RI=-1.0
      DO 1 I=1, 25
          RI=RI+.04
1          SPAN(I)=RI

```

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

      IDEV=0
      CALL LEZINI(IDEV)

```

C---SET UP A LINE PLOT---

```

C      ESTABLISH CHART AS A LINE CHART, AND ENTER FIRST DATA SET.
C      *** NOTE: AUTOSCALED AXIS IS OBTAINED BY SETTING 'INDMIN' EQUAL
C      TO 'INDMAX'.

```

```

      NVALS=25
      TITLE='V[BLC]ORTEX FLOW ABOUT A 60[BSUP]O[ESUP] DELTA WING WITH [F
+ONT=9]A[FONT]=20[BSUP]O'
      IAXLBL='2[BLC]Y/B'
      DAXLBL='A[BLC]ERODYNAMIC PROPERTIES'
      INDMIN=0.
      INDMAX=0.
      DEPMIN=-2.0
      DEPMAX=2.0
      INDHV=1
      LINAPP=2
      CALL LEZLIN(SPAN, CLIFT, NVALS, TITLE, IAXLBL, DAXLBL, INDMIN, INDMAX,
+DEPMIN, DEPMAX, INDHV, LINAPP)

```

C---CREATE A KEY---

```

      TITLE=' '
      XPOS=6.25
      YPOS=6.35
      KENTRY='C[BSUB][BLC][FONT=11]L'
      CALL LEZKEY(TITLE, XPOS, YPOS, KENTRY)

```

C---CREATE A NUMERIC AXIS---

```

      IHV=2

```

```

NDEC=-1
TSTART=-2.0
TINCR=1.0
TEND=2.0
NTMINR=4
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

```

C---INPUT ADDITIONAL DATA SETS---

```

NVALS=25
IDTREL=1
LINAPP=2
KENTRY='C[BSUB][BLC]D'
CALL LEZDAT(CDRAG,NVALS,IDTREL,LINAPP,KENTRY)
NVALS=25
IDTREL=1
LINAPP=2
KENTRY='C[BSUB][BLC]M'
CALL LEZDAT(CMOMNT,NVALS,IDTREL,LINAPP,KENTRY)

```

```

CALL LEZNOT('CGLIN1',7.,0.,3,1,0)

```

C---SHOW CHART---

```

CALL LEZSHW

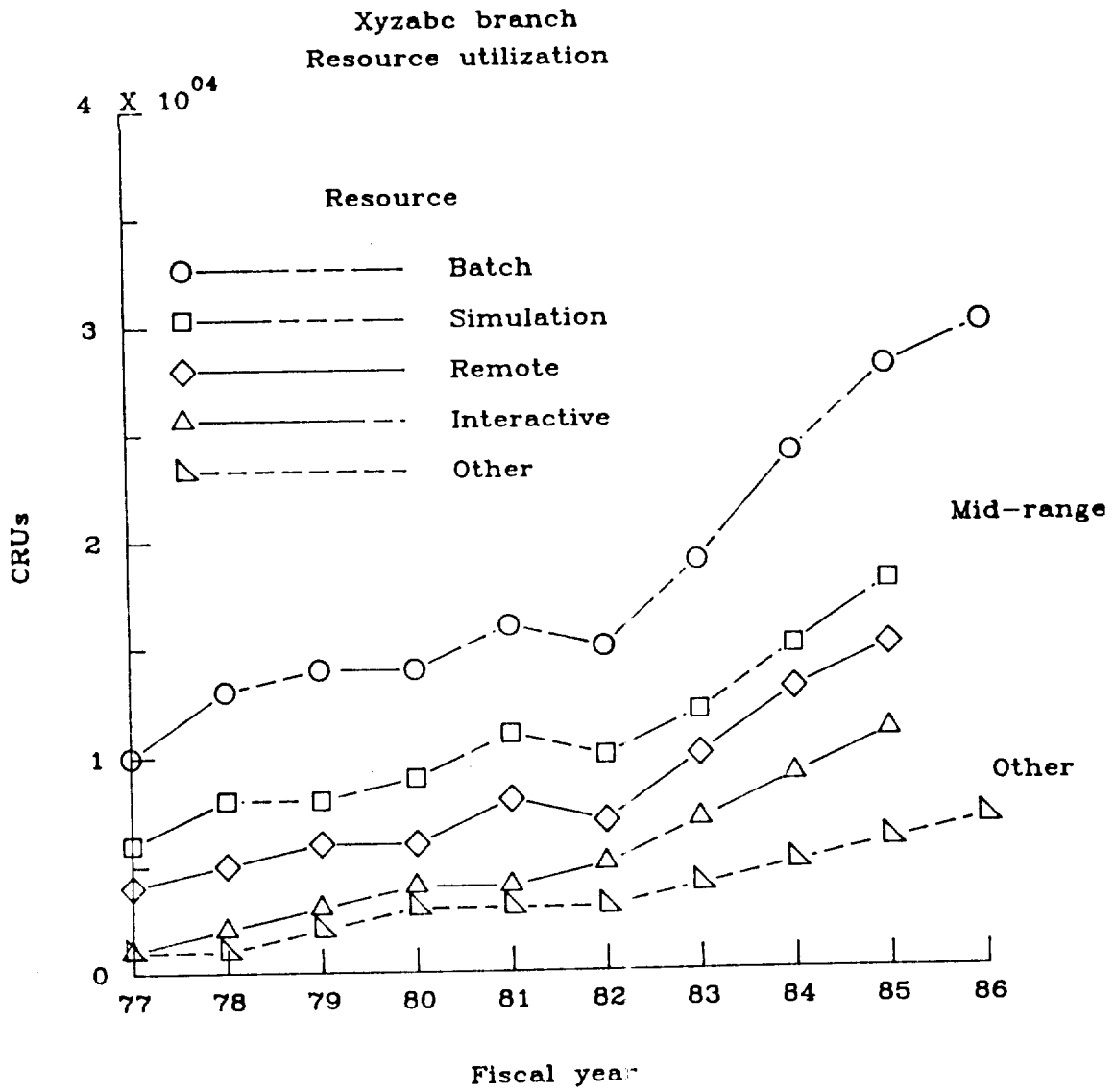
```

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

CALL LEZTRM
STOP
END

```



CGLIN2

PROGRAM CGLIN2

```

C
C-----
C
C THIS EXAMPLE DRAWS A MULTI-LINE GRAPH WITH A KEY
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C    NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINCR - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZAXS (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINCR - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         IEXP - POWER OF 10 TO BE USED,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZDAT (DEPARTY - ADDITIONAL DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         IDTREL - RELATIONSHIP BETWEEN DEPENDENT DATA SETS
C                1:ABSOLUTE 2:ADDITIVE,
C         IDTAPP - APPEARANCE INDICATOR
C                FOR BARS: 0:UNFILLED 1:FILLED
C                FOR LINES: 1:LINES 2:MARKERS 3:BOTH,
C         KENTRY - KEY ENTRY LABEL FOR THIS DATA SET)
C
C LEZINI (IDDEV - DI-3000 LOGICAL DEVICE NUMBER
C          0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZKEY (TITLE - TITLE OF GRAPH,
C         XPOS - X POSITION ON THE PAGE,
C         YPOS - Y POSITION ON THE PAGE,
C         KENTRY - FIRST KEY ENTRY LABEL)
C         KEY IS POSITIONED ACCORDING TO THE UPPER RIGHT CORNER
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C         DEPARTY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA PAIRS,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT AXIS MINIMUM,
C         INDMAX - INDEPENDENT AXIS MAXIMUM,
C         DEPMIN - DEPENDENT AXIS MINIMUM,
C         DEPMAX - DEPENDENT AXIS MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)

```



```

C
C LEZNOT (STRING - NOTE,
C      XPOS - X POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C      YPOS - Y POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C      IHJST - HORIZONTAL JUSTIFICATION 1:LEFT 2:CENTER 3:RIGHT,
C      IVJST - VERTICAL JUSTIFICATION 1:BOTTOM 2:CENTER 3:TOP,
C      IANG - ANGLE OF ROTATION ABOUT THE JUSTIFICATION POINT)
C      ANGLE OF ROTATION IS MEASURED COUNTERCLOCKWISE
C      FROM THE HORIZONTAL AXIS.
C
C LEZOPT (IOPT - OPTION NUMBER,
C      IVALS - OPTION VALUE(S))
C
C LEZSHW
C
C LEZTRM
C
C-----

```

C---DATA SECTION---

```

      CHARACTER*80 TITLE, IAXLBL, DAXLBL, KENTRY, STRING
      CHARACTER*10 OPTION
      REAL YEAR(10), BATCH(10), SIMUL(9), REMOTE(9), IAF(9)
      REAL OTHER(10), INDMIN, INDMAX
      INTEGER LINPAT(5)

      DATA YEAR/77.,78.,79.,80.,81.,82.,83.,84.,85.,86./
      DATA BATCH/10.,13.,14.,14.,16.,15.,19.,24.,28.,30./
      DATA SIMUL/6.,8.,8.,9.,11.,10.,12.,15.,18./
      DATA REMOTE/4.,5.,6.,6.,8.,7.,10.,13.,15./
      DATA IAF/1.,2.,3.,4.,4.,5.,7.,9.,11./
      DATA OTHER/1.,1.,2.,3.,3.,3.,4.,5.,6.,7./

      DO 1 I=1,9
        BATCH(I)=BATCH(I)*1000.
        SIMUL(I)=SIMUL(I)*1000.
        REMOTE(I)=REMOTE(I)*1000.
        IAF(I)=IAF(I)*1000.
        OTHER(I)=OTHER(I)*1000.
1      CONTINUE
        BATCH(10)=BATCH(10)*1000.
        OTHER(10)=OTHER(10)*1000.

```

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000---

```

      IDEV=1
      CALL LEZINI (IDEV)

```

C---SET UP A LINE PLOT---

```

      NVALS=10
      TITLE=' '
      IAXLBL='F[BLC]ISCAL YEAR'

```

```

DAXLBL='CRU[BLC]S'
INDMIN=77.0
INDMAX=86.0
DEPMIN=0.0
DEPMAX=40000.0
INDHV=1
LINAPP=3
CALL LEZLIN (YEAR,BATCH,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+          DEPMIN,DEPMAX,INDHV,LINAPP)

```

C---CREATE A KEY---

```

TITLE='R[BLC]ESOURCE'
XPOS=4.5
YPOS=6.0
KENTRY='B[BLC]ATCH'
CALL LEZKEY (TITLE,XPOS,YPOS,KENTRY)

```

C---CREATE AN INTEGER AXIS---

```

IHV=1
I2=-2
NDEC=I2
TSTART=77.0
TINCR=1.0
TEND=86.0
NTMINR=0
CALL LEZAXN (IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

```

C---CREATE AN AXIS WITH SCIENTIFIC NOTATION---

```

IHV=2
TSTART=0.0
TINCR=10000.0
TEND=40000.0
IEXP=4
NTMINR=1
CALL LEZAXS (IHV,TSTART,TINCR,TEND,IEXP,NTMINR)

```

C---INPUT ADDITIONAL DATA SETS---

```

NVALS=9
IDTREL=1
IDTAPP=3
KENTRY='S[BLC]IMULATION'
CALL LEZDAT (SIMUL,NVALS,IDTREL,IDTAPP,KENTRY)

KENTRY='R[BLC]EMOTE'
CALL LEZDAT (REMOTE,NVALS,IDTREL,IDTAPP,KENTRY)

KENTRY='I[BLC]INTERACTIVE'
CALL LEZDAT (IAF,NVALS,IDTREL,IDTAPP,KENTRY)

NVALS=10

```

```

        KENTRY='O[BLC]THER'
        CALL LEZDAT (OTHER,NVALS,IDTREL,DTAPP,KENTRY)

C---SET OPTION---

C---CHANGE LINE PATTERNS.

        OPTION='LINPAT'
        LINPAT(1)=4
        LINPAT(2)=5
        LINPAT(3)=1
        LINPAT(4)=3
        LINPAT(5)=2
        CALL LEZOPT(OPTION,LINPAT)

C---PUT TWO LINE TITLE AT TOP OF PAGE---

        STRING='X[BLC]YZABC BRANCH'
        XPOS=3.5
        YPOS=6.7
        IHJST=2
        IVJST=2
        IANG=0
        CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANGL)

        STRING='R[BLC]ESOURCE UTILIZATION'
        YPOS=6.5
        CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANGL)

C---PUT NOTES BESIDE DATA SPACE---

        STRING='O[BLC]THER'
        XPOS=6.5
        YPOS=2.6
        CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANGL)

        STRING='M[BLC]ID-RANGE'
        YPOS=4.0
        CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANGL)

        CALL LEZNOT('CGLIN2',7.,0.,3,1,0)
C---SHOW GRAPH---

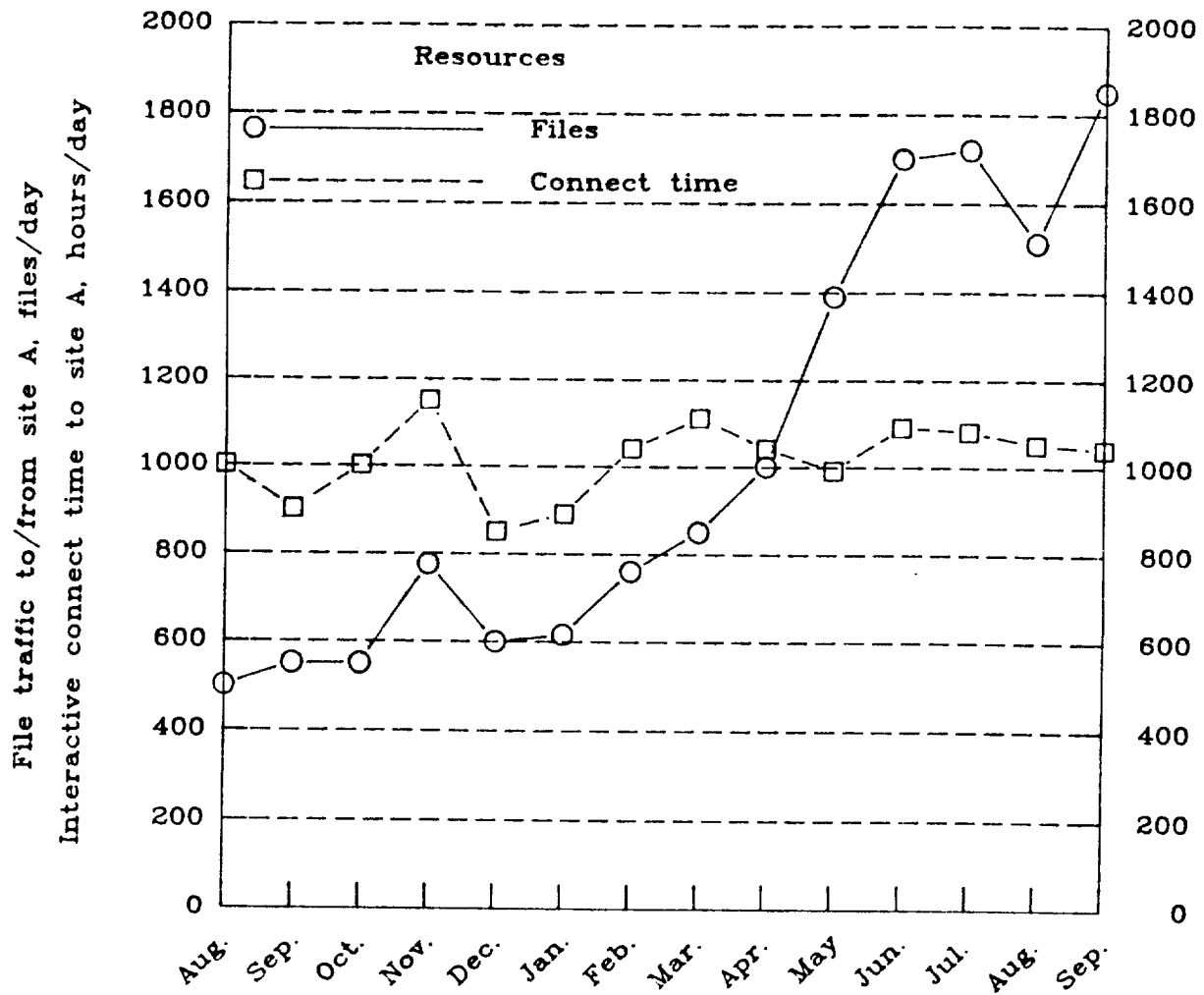
        CALL LEZSHW

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000---

        CALL LEZTRM
        STOP
        END

```

File traffic & interactive access for site A
Data communication to/from site A



CGLIN3

PROGRAM CGLIN3

```

C
C-----
C
C THIS EXAMPLE DRAWS A MULTI-LINE GRAPH WITH A KEY
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C   NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C        NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C        TSTART - FIRST MAJOR TICK MARK VALUE,
C        TINC - MAJOR TICK MARK INCREMENT,
C        TEND - LAST MAJOR TICK MARK VALUE,
C        NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZAXT (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C        NLABS - NUMBER OF TICK MARK LABELS IN STRING,
C        LABELS - TICK MARK LABELS,
C        NTMAJR - NUMBER OF MAJOR TICK MARKS,
C        NTMINR - NUMBER OF MINOR TICK MARK PER INCREMENT)
C
C LEZDAT (DEPARY - ADDITIONAL DEPENDENT DATA SET,
C        NVALS - NUMBER OF DATA VALUES,
C        IDTREL - RELATIONSHIP BETWEEN DEPENDENT DATA SETS
C              1:ABSOLUTE 2:ADDITIVE,
C        IDTAPP - APPEARANCE INDICATOR
C              FOR BARS: 0:UNFILLED 1:FILLED
C              FOR LINES: 1:LINES 2:MARKERS 3:BOTH,
C        KENTRY - KEY ENTRY LABEL FOR THIS DATA SET)
C
C LEZINI (IDDEV - DI-3000 LOGICAL DEVICE NUMBER
C          0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZKEY (TITLE - TITLE OF GRAPH,
C        XPOS - X POSITION ON THE PAGE,
C        YPOS - Y POSITION ON THE PAGE,
C        KENTRY - FIRST KEY ENTRY LABEL)
C        KEY IS POSITIONED ACCORDING TO THE UPPER RIGHT CORNER
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C        DEPARY - DEPENDENT DATA SET,
C        NVALS - NUMBER OF DATA PAIRS,
C        TITLE - TITLE OF GRAPH,
C        IAXLBL - INDEPENDENT AXIS LABEL,
C        DAXLBL - DEPENDENT AXIS LABEL,
C        INDMIN - INDEPENDENT AXIS MINIMUM,
C        INDMAX - INDEPENDENT AXIS MAXIMUM,
C        DEPMIN - DEPENDENT AXIS MINIMUM,
C        DEPMAX - DEPENDENT AXIS MAXIMUM,
C        INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C        LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C

```

```

C LEZNOT (STRING - NOTE,
C      XPOS - X POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C      YPOS - Y POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C      IHJST - HORIZONTAL JUSTIFICATION 1:LEFT 2:CENTER 3:RIGHT,
C      IVJST - VERTICAL JUSTIFICATION 1:BOTTOM 2:CENTER 3:TOP,
C      IANG - ANGLE OF ROTATION ABOUT THE JUSTIFICATION POINT)
C      ANGLE OF ROTATION IS MEASURED COUNTERCLOCKWISE
C      FROM THE HORIZONTAL AXIS.
C

```

```

C LEZOPT (IOPT - OPTION NAME,
C      IVALS - OPTION VALUE(S))
C

```

```

C LEZSHW
C

```

```

C LEZTRM
C

```

```

C-----

```

```

C---DATA SECTION---

```

```

      CHARACTER LABELS*256,TITLE*80,IAXLBL*1,DAXLBL*1,KENTRY*80
      CHARACTER IOPT*8,STRING*80
      REAL SITEAF(14),CONNT(14),MOS(14),INDMIN,INDMAX
      LOGICAL LVALUE

```

```

      DATA SITEAF/500.,550.,550.,775.,599.,615.,760.,850.,1000.,1390.,
+1700.,1720.,1510.,1850./

```

```

      DATA CONNT/1000.,900.,1000.,1150.,850.,890.,1040.,1110.,1040.,
+990.,1090.,1080.,1050.,1040./

```

```

      DO 1 I=1,14

```

```

        RI=I

```

```

1      MOS(I)=RI

```

```

C---DESIRED MINS AND MAXS FOR FINISHED GRAPH---

```

```

      INDMIN=1.0
      INDMAX=14.0
      DEPMIN=0.0
      DEPMAX=2000.

```

```

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

```

      IDEV=1
      CALL LEZINI(IDEV)

```

```

C---SET UP A LINE PLOT---

```

```

      NVALS=14
      TITLE=' '
      IAXLBL=' '
      DAXLBL=' '
      INDHV=1
      LINAPP=3
      CALL LEZLIN(MOS,SITEAF,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,

```

+DEPMIN,DEPMAX,INDHV,LINAPP)

C---CREATE A KEY---

TITLE='R[BLC]ESOURCES'
XPOS=4.5
YPOS=6.3
KENTRY='F[BLC]ILES'
CALL LEZKEY(TITLE,XPOS,YPOS,KENTRY)

C---CREATE A TEXT AXIS---

IHV=1
NLABS=14
LABELS='SA[BLC]UG.\$S[BLC]EP.\$O[BLC]CT.\$N[BLC]OV.\$D[BLC]EC.\$J[BLC]A
+N.\$F[BLC]EB.\$M[BLC]AR.\$A[BLC]PR.\$M[BLC]AY\$J[BLC]UN.\$J[BLC]UL.\$A[BL
+C]UG.\$S[BLC]EP.\$'
NTMAJR=14
NTMINR=0
CALL LEZAXT(IHV,NLABS,LABELS,NTMAJR,NTMINR)

C---CREATE AN INTEGER AXIS---

IHV=2
I4=-4
NDEC=I4
TSTART=DEPMIN
TINCR=200.0
TEND=DEPMAX
NTMINR=0
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

C---INPUT AN ADDITIONAL DATA SET---

NVALS=14
IDTREL=1
LINAPP=3
KENTRY='C[BLC]ONNECT TIME'
CALL LEZDAT(CONNT,NVALS,IDTREL,LINAPP,KENTRY)

C---SET OPTIONS---

C---ROTATE TICK MARK LABELS ON THE HORIZONTAL AXIS , 45 DEGREES.

IOPT='HTLABR'
IVAL=45
CALL LEZOPT(IOPT,IVAL)

C---SET FLAG TO DRAW RIGHT AXIS , TRUE.

IOPT='RTAXIS'
LVALUE=.TRUE.
CALL LEZOPT(IOPT,LVALUE)

C---SET FLAG FOR DASHED LINES ACROSS DATA SPACE , TRUE.

```
IOPT='DASH'  
LVALUE=.TRUE.  
CALL LEZOPT(IOPT,LVALUE)
```

C---PUT TWO LABELS ON DEPENDENT AXIS---

```
STRING='F[BLC]ILE TRAFFIC TO/FROM SITE [ELC]A[BLC], FILES/DAY'  
XPOS=.5  
YPOS=4.0  
IHJST=2  
IVJST=2  
IANG=90  
CALL LEZNOT(STRING,XPOS,YPOS,IHJST,IVJST,IANG)
```

```
STRING='I[BLC]INTERACTIVE CONNECT TIME TO SITE [ELC]A[BLC], HOURS/D  
+AY'  
XPOS=.75  
CALL LEZNOT(STRING,XPOS,YPOS,IHJST,IVJST,IANG)
```

C---PUT TWO LINE TITLE AT TOP OF PAGE---

```
STRING='D[BLC]ATA COMMUNICATION TO/FROM SITE [ELC]A'  
XPOS=3.9  
YPOS=6.6  
IHJST=2  
IVJST=2  
IANG=0  
CALL LEZNOT(STRING,XPOS,YPOS,IHJST,IVJST,IANG)
```

```
STRING='F[BLC]ILE TRAFFIC & INTERACTIVE ACCESS FOR SITE [ELC]A'  
YPOS=6.8  
CALL LEZNOT(STRING,XPOS,YPOS,IHJST,IVJST,IANG)
```

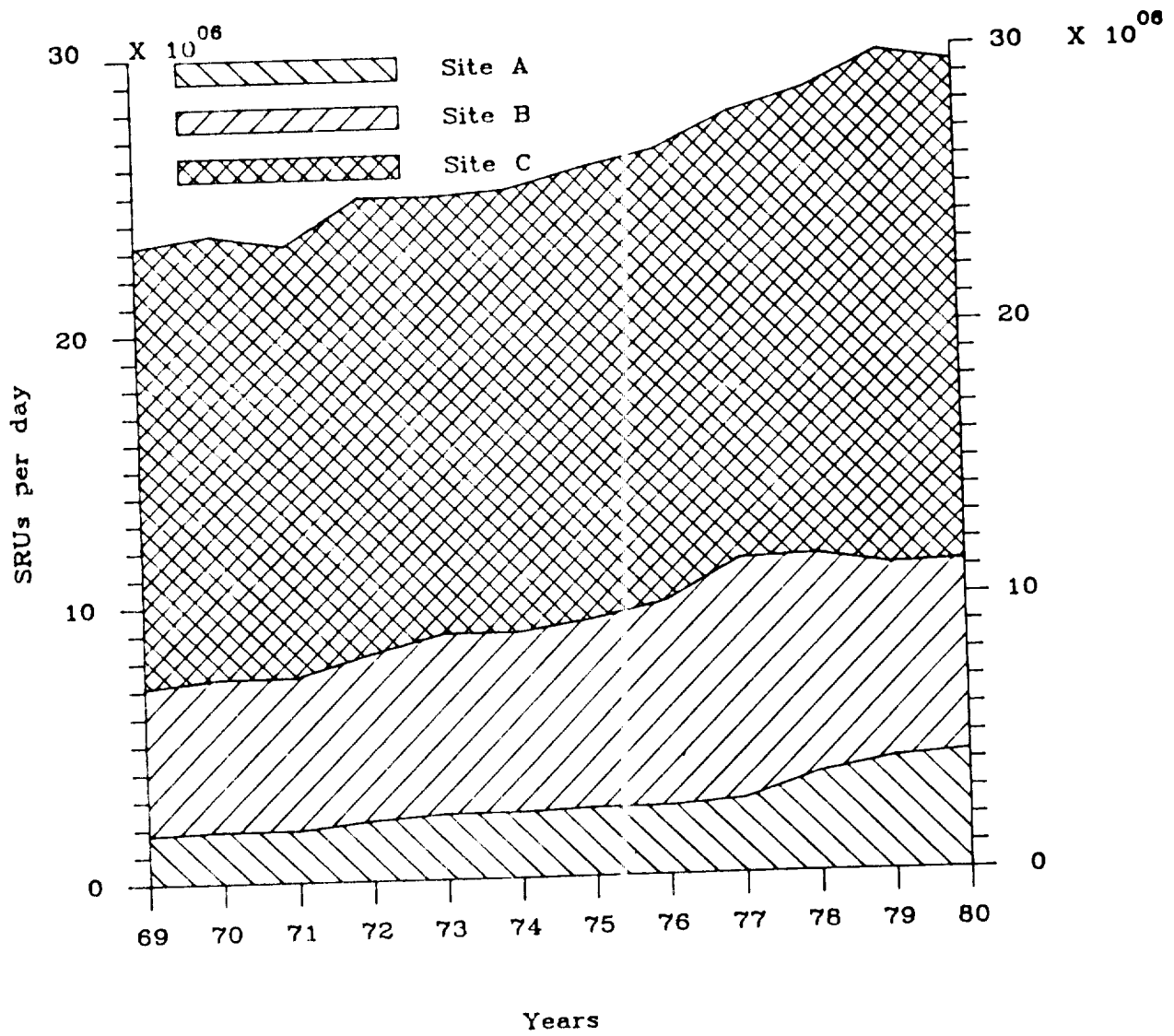
```
CALL LEZNOT('CGLIN3',7.,0.,3,1,0)
```

C---SHOW GRAPH---

```
CALL LEZSHW
```

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```
CALL LEZTRM  
STOP  
END
```

Resource utilization

CGLIN4

PROGRAM CGLIN4

```

C
C-----
C
C THIS EXAMPLE DRAWS A MULTI-LINE GRAPH WITH COLOR FILLING
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C     NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINC - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZAXS (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINC - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         IEXP - POWER OF 10 TO BE USED,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZDAT (DEPARY - ADDITIONAL DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         IDTREL - RELATIONSHIP BETWEEN DEPENDENT DATA SETS
C               1:ABSOLUTE 2:ADDITIVE,
C         IDTAPP - APPEARANCE INDICATOR
C               FOR BARS: 0:UNFILLED 1:FILLED
C               FOR LINES: 1:LINES 2:MARKERS 3:BOTH,
C         KENTRY - KEY ENTRY LABEL FOR THIS DATA SET)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZKEY (TITLE - TITLE OF GRAPH,
C         XPOS - X POSITION ON THE PAGE,
C         YPOS - Y POSITION ON THE PAGE,
C         KENTRY - FIRST KEY ENTRY LABEL)
C         KEY IS POSITIONED ACCORDING TO THE UPPER RIGHT CORNER
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA PAIRS,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT AXIS MINIMUM,
C         INDMAX - INDEPENDENT AXIS MAXIMUM,
C         DEPMIN - DEPENDENT AXIS MINIMUM,
C         DEPMAX - DEPENDENT AXIS MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)

```

```

C
C LEZOPT (IOPT - OPTION NAME,
C         IVALS - OPTION VALUE(S))
C
C LEZSHW
C
C LEZTRM
C
C-----

```

C---DATA SECTION---

```

      CHARACTER TITLE*80, IAXLBL*80, DAXLBL*80, KENTRY*80, LABELS*80
      CHARACTER IOPT*8
      INTEGER IDTREL, LINCOL(3)
      LOGICAL LVALUE
      REAL YEAR(12), SITEA(12), SITEB(12), SITEC(12), INDMIN, INDMAX
      DATA YEAR/69., 70., 71., 72., 73., 74., 75., 76., 77.,
+ 78., 79., 80./
      DATA SITEA/1.8, 1.9, 1.9, 2.2, 2.4, 2.4, 2.5, 2.5, 2.7,
+ 3.6, 4.1, 4.3/
      DATA SITEB/7.1, 7.4, 7.4, 8.2, 8.9, 8.9, 9.3, 9.9, 11.4,
+ 11.5, 11.1, 11.2/
      DATA SITEC/23.2, 23.6, 23.2, 24.9, 24.9, 25.1, 25.8,
+ 26.4, 27.7, 28.5, 29.8, 29.4/

      DO 1 I=1, 12
        SITEA(I)=SITEA(I)*10.**6
        SITEB(I)=SITEB(I)*10.**6
        SITEC(I)=SITEC(I)*10.**6
1      CONTINUE

```

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

      IDEV=1
      CALL LEZINI(IDEV)

```

C---SET UP A LINE GRAPH---

```

      NVALS=12
      TITLE='R[BLC]ESOURCE UTILIZATION'
      IAXLBL='Y[BLC]EARS'
      DAXLBL='SRU[BLC]S PER DAY'
      INDMIN=69.
      INDMAX=80.
      DEPMIN=0.
      DEPMAX=30.*10.**6
      INDHV=1
      LINAPP=1
      CALL LEZLIN(YEAR, SITEA, NVALS, TITLE, IAXLBL, DAXLBL, INDMIN, INDMAX,
+DEPMIN, DEPMAX, INDHV, LINAPP)

```

C---CREATE A KEY---

```

TITLE=' '
XPOS=3.5
YPOS=6.4
KENTRY='S[BLC]ITE [ELC]A'
CALL LEZKEY(TITLE,XPOS,YPOS,KENTRY)

C---CREATE A NUMERIC AXIS---

IHV=1
NDEC=-2
TSTART=69.0
TINCR=1.
TEND=80.0
NTMINR=0
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

C---CREATE AN AXIS WITH SCIENTIFIC NOTATION---

IHV=2
TSTART=0.0
TINCR=10.**7
TEND=30.0*10.**6
IEXP=6
NTMINR=9
CALL LEZAXS(IHV,TSTART,TINCR,TEND,IEXP,NTMINR)

C---INPUT ADDITIONAL DATA SETS---

NVALS=12
IDTREL=1
LINAPP=1
KENTRY='S[BLC]ITE [ELC]B'
CALL LEZDAT(SITEB,NVALS,IDTREL,LINAPP,KENTRY)

KENTRY='S[BLC]ITE [ELC]C'
CALL LEZDAT(SITEC,NVALS,IDTREL,LINAPP,KENTRY)

C---SET OPTIONS---

C---SET FLAG TO DRAW THE RIGHT AXIS , TRUE.

IOPT='RTAXIS'
LVALUE=.TRUE.
CALL LEZOPT(IOPT,LVALUE)

C---CHANGE X COORDINATE OF X-AXIS.

IOPT='XORIGIN'
RVALUE=1.
CALL LEZOPT(IOPT,RVALUE)

C---CHANGE PLOTTED LINE COLORS , ARRAY OF DESIRED COLORS.

IOPT='COLOR'

```

```

        LINCOL(1)=5
        LINCOL(2)=4
        LINCOL(3)=1
        CALL LEZOPT(IOPT,LINCOL)

C---SET FLAGS TO COLOR FILL BETWEEN PLOTTED LINES

        IOPT='BFILLD'
        LINCOL(1)=1
        LINCOL(2)=1
        LINCOL(3)=1
        CALL LEZOPT(IOPT,LINCOL)

C---CHANGE POSITION OF HORIZONTAL AXIS TICK MARKS , OUTSIDE DATA SPACE.

        IOPT='HTICPOS'
        IVALUE=2
        CALL LEZOPT(IOPT,IVALUE)

C---CHANGE POSITION OF VERTICAL AXIS TICK MARKS , OUTSIDE DATA SPACE.

        IOPT='VTICPOS'
        IVALUE=2
        CALL LEZOPT(IOPT,IVALUE)

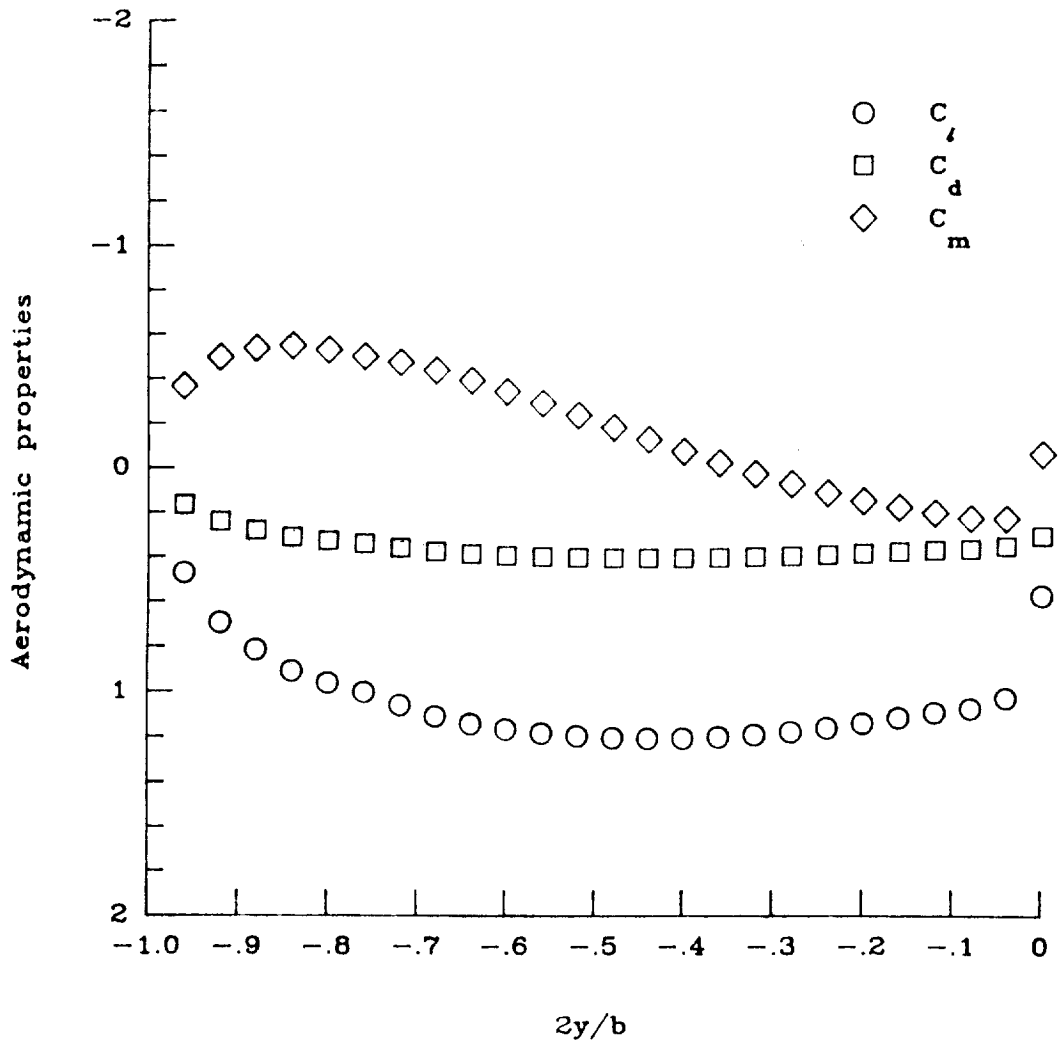
        CALL LEZNOT('CGLIN4',7.,0.,3,1,0)
C---SHOW GRAPH---

        CALL LEZSHW

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

        CALL LEZTRM
        STOP
        END

```



Vortex flow about a 60° delta wing with $\alpha=20^\circ$

CGLIN5

PROGRAM CGLIN5

```

C-----
C
C THIS EXAMPLE DRAWS A MULTI-LINE CHART WITH A DECREASING VERTICAL AXIS.
C THE COMMENTS IN THIS PROGRAM EMPHASIZE DECREASING AXES.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C     NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINC - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         NDMIN - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZDAT (DEPARY - ADDITIONAL DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         IDTREL - RELATIONSHIP BETWEEN DEPENDENT DATA SETS
C                   1:ABSOLUTE 2:ADDITIVE,
C         IDTAPP - APPEARANCE INDICATOR
C                   FOR BARS: 0:UNFILLED 1:FILLED
C                   FOR LINES: 1:LINES 2:MARKERS 3:BOTH,
C         LENTRY - KEY ENTRY LABEL FOR THIS DATA SET)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZKEY (TITLE - TITLE OF CHART,
C         XPOS - X POSITION ON THE PAGE,
C         YPOS - Y POSITION ON THE PAGE,
C         KENTRY - FIRST KEY ENTRY LABEL)
C         KEY IS POSITIONED ACCORDING TO THE UPPER RIGHT CORNER
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA PAIRS,
C         TITLE - TITLE OF CHART,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT AXIS MINIMUM,
C         INDMAX - INDEPENDENT AXIS MAXIMUM,
C         DEPMIN - DEPENDENT AXIS MINIMUM,
C         DEPMAX - DEPENDENT AXIS MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C
C LEZSHW
C
C LEZTRM
C-----

```

C---VARIABLE DECLARATION AND INITIALIZATION---

```

      CHARACTER TITLE*128,IAXLBL*80,DAXLBL*80,KENTRY*80
      REAL SPAN(25),CLIFT(25),CDRAG(25),CMOMNT(25),INDMIN,INDMAX
      DATA CLIFT/.4748,.6962,.8165,.9102,.9631,1.005,1.063,1.112,
+1.146,1.170,1.187,1.199,1.207,1.210,1.209,1.203,1.193,1.180,
+1.163,1.142,1.117,1.094,1.076,1.028,.5721/
      DATA CDRAG/.1674,.2426,.2827,.3137,.3307,.3439,.3629,.3789,
+.3897,.3971,.4021,.4056,.4077,.4084,.4076,.4054,.4020,.3975,
+.3919,.3852,.3776,.3705,.3652,.3519,.3038/
      DATA CMOMNT/-.3639,-.4936,-.5337,-.5454,-.5263,-.4971,-.4704,
+-.4348,-.3902,-.3404,-.2878,-.2336,-.1790,-.1246,-.07136,
+-.02016,.02818,.07293,.1133,.1484,.1774,.2022,.2261,.2264,-.06216/
      RI=-1.0
      DO 1 I=1,25
        RI=RI+.04
1      SPAN(I)=RI

```

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

      IDEV=0
      CALL LEZINI(IDEV)

```

C---SET UP A LINE PLOT---

```

C      ESTABLISH CHART AS A LINE CHART, AND ENTER FIRST DATA SET.
C      *** NOTE: DECREASING AXIS IS OBTAINED BY SETTING 'DEPMIN' TO BE
C      GREATER THAN 'DEPMAX'.

```

```

      NVALS=25
      TITLE='V[BLC]ORTEX FLOW ABOUT A 60[BSUP]O[ESUP] DELTA WING WITH [F
+ONT=9]A[FONT]=20[BSUP]O'
      IAXLBL='2[BLC]Y/B'
      DAXLBL='A[BLC]ERODYNAMIC PROPERTIES'
      INDMIN=-1.
      INDMAX=0.
      DEPMIN=2.0
      DEPMAX=-2.0
      INDHV=1
      LINAPP=2
      CALL LEZLIN(SPAN,CLIFT,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+DEPMIN,DEPMAX,INDHV,LINAPP)

```

C---CREATE A KEY---

```

      TITLE=' '
      XPOS=6.0
      YPOS=6.0
      KENTRY='C[BSUB][BLC][FONT=11]L'
      CALL LEZKEY(TITLE,XPOS,YPOS,KENTRY)

```

C---CREATE A NUMERIC AXIS---

```

      IHV=2

```



```

NDEC=-1
TSTART=2.0
TINCR=-1.0
TEND=-2.0
NTMINR=4
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

```

C---INPUT ADDITIONAL DATA SETS---

```

NVALS=25
IDTREL=1
LINAPP=2
KENTRY='C[BSUB][BLC]D'
CALL LEZDAT(CDRAG,NVALS,IDTREL,LINAPP,KENTRY)
NVALS=25
IDTREL=1
LINAPP=2
KENTRY='C[BSUB][BLC]M'
CALL LEZDAT(CMOMNT,NVALS,IDTREL,LINAPP,KENTRY)

```

```

CALL LEZNOT('CGLIN5',7.,0.,3,1,0)

```

C---SHOW CHART---

```

CALL LEZSHW

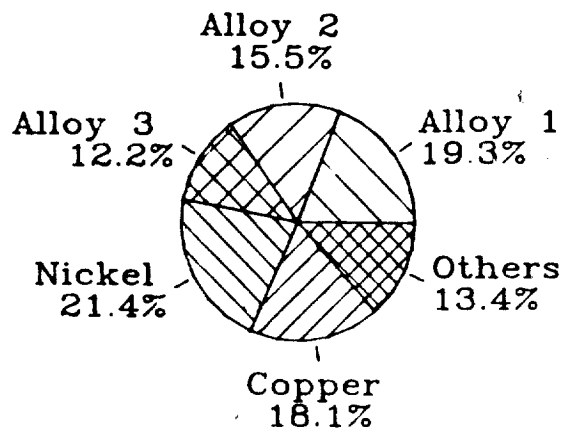
```

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

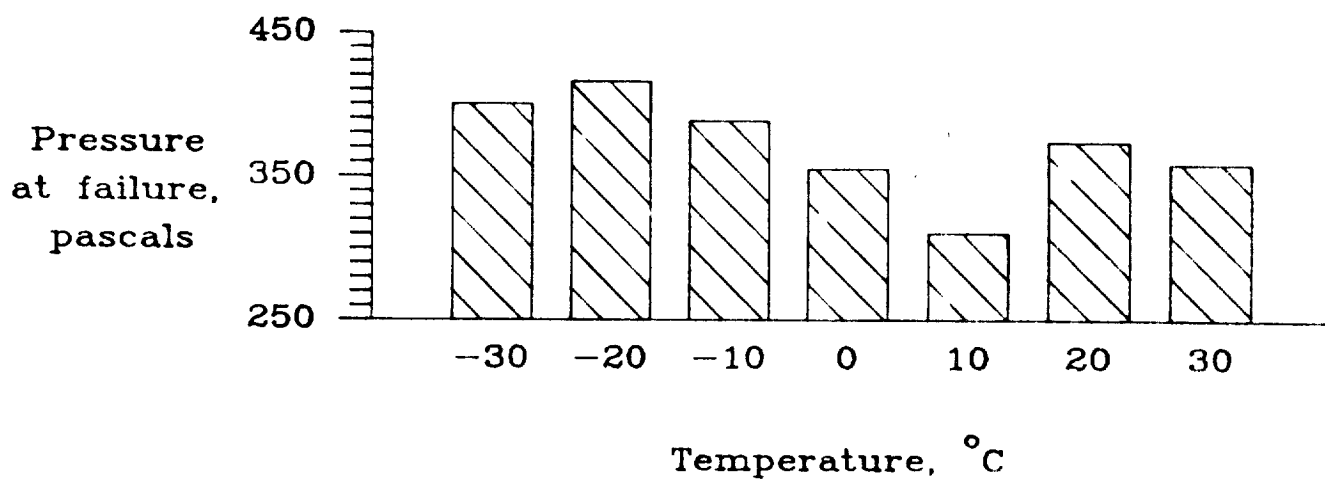
```

CALL LEZTRM
STOP
END

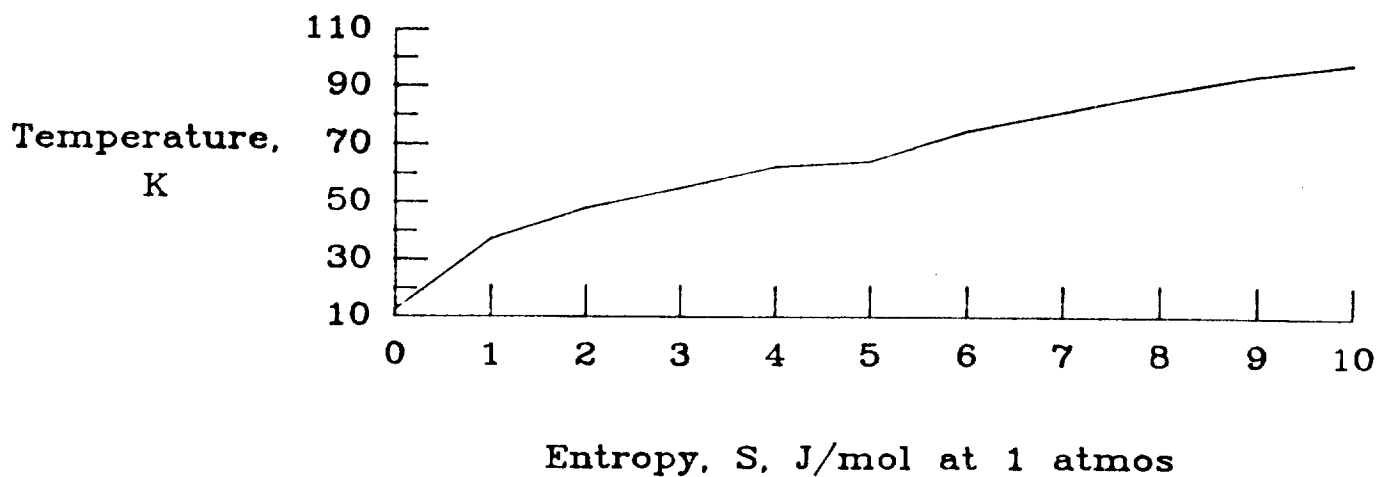
```



a) Composition of Superalloy



b) Low pressure fatigue of Superalloy



c) Temperature vs. entropy for Superalloy

PROGRAM CGMIX1

```

C-----
C
C THIS EXAMPLE DRAWS A LINE, A BAR, AND A PIE CHART ON ONE PAGE.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C   NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINCR - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZBAR (INDARY - INDEPENDENT DATA SET,
C         DEPARTY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT DATA MINIMUM,
C         INDMAX - INDEPENDENT DATA MAXIMUM,
C         DEPMIN - DEPENDENT DATA MINIMUM,
C         DEPMAX - DEPENDENT DATA MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         IBRAPP - APPEARANCE INDICATOR 0:UNFILLED 1:FILLED)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C         DEPARTY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA PAIRS,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT AXIS MINIMUM,
C         INDMAX - INDEPENDENT AXIS MAXIMUM,
C         DEPMIN - DEPENDENT AXIS MINIMUM,
C         DEPMAX - DEPENDENT AXIS MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C
C LEZNOT (STRING - NOTE,
C         XPOS - X POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C         YPOS - Y POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C         IHJST - HORIZONTAL JUSTIFICATION 1:LEFT 2:CENTER 3:RIGHT,
C         IVJST - VERTICAL JUSTIFICATION 1:BOTTOM 2:CENTER 3:TOP,
C         IANG - ANGLE OF ROTATION ABOUT THE JUSTIFICATION POINT)
C         ANGLE OF ROTATION IS MEASURED COUNTERCLOCKWISE
C         FROM THE HORIZONTAL AXIS.

```

```

C
C LEZOPT (IOPT - OPTION NUMBER,
C         IVALS - OPTION VALUE(S))
C
C LEZPIE (SEGS - DATA SET,
C         NUM - NUMBER OF DATA VALUES,
C         TITLE - TITLE OF GRAPH,
C         NEXP1 - NUMBER OF FIRST EXPLODED SEGMENT,
C         NEXP2 - NUMBER OF LAST EXPLODED SEGMENT,
C         LFORM1 - QUANTITY LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY,
C         LFORM2 -PERCENTAGE LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY)
C
C LEZPGE (XVAL - WIDTH OF DESIRED PAGE,
C         YVAL - HEIGHT OF DESIRED PAGE)
C
C LEZPLB (NOPLB - SEGMENT NUMBER ASSOCIATED WITH LABEL,
C         LABEL - SEGMENT LABELS,
C         KEY - KEY ENTRY LABEL FOR THIS SEGMENT)
C
C LEZSHW
C
C LEZTRM
C
C-----

```

C---DATA SECTION---

```

      REAL  INDMAX, INDMIN
      REAL COMP(6),CELS(7),PRESS(7),ENTRPY(11),KELVN(11)

      CHARACTER*80 TITLE,STRING,LABEL,IAXLBL,DAXLBL,KEY,LABELS

      DATA COMP/4.6,3.7,2.9,5.1,4.3,3.2/
      DATA CELS/-30.,-20.,-10.,0.,10.,20.,30./
      DATA PRESS/400.,415.8,388.2,355.3,310.6,373.7,358.4/
      DATA ENTRPY/0.,1.,2.,3.,4.,5.,6.,7.,8.,9.,10./
      DATA KELVN/12.6,37.2,48.,55.,62.4,64.4,74.8,81.3,88.1,94.1,98.3/

```

C---SET UP NON-DEFAULT PAGE SIZE---

```

      XVAL=7.0
      YVAL=9.0
      CALL LEZPGE (XVAL,YVAL)

```

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

      IDEV=0
      CALL LEZINI (IDEV)

```

C---SET UP PIE GRAPH---

```

      NUM = 6
      TITLE = ' '

```

```

NEXP1 = 0
NEXP2 = 0
LFORM1 = 0
LFORM2 = 1
CALL LEZPIE (COMP,NUM,TITLE,NEXP1,NEXP2,LFORM1,LFORM2)

```

C---MAKE KEY ENTRIES---

```

NOPLB = 1
LABEL = 'A[BLC]LLOY 1'
KEY = ' '
CALL LEZPLB (NOPLB,LABEL,KEY)
CALL LEZPLB (2,'A[BLC]LLOY 2',' ')
CALL LEZPLB (3,'A[BLC]LLOY 3',' ')
CALL LEZPLB (4,'N[BLC]ICKEL',' ')
CALL LEZPLB (5,'C[BLC]OPPER',' ')
CALL LEZPLB (6,'O[BLC]THERS',' ')

```

C---SET OPTIONS---

```

C---CHANGE RADIUS OF PIE.
CALL LEZOPT ('RADIUS',0.62)
C---CHANGE X COORDINATE OF ORIGIN.
CALL LEZOPT ('XORIGIN',3.5)
C---CHANGE Y COORDINATE OF ORIGIN.
CALL LEZOPT ('YORIGIN',7.8)
C---SET FLAG TO NOT CLEAR SCREEN AFTER LEZSHW.
CALL LEZOPT ('CLEAR',.FALSE.)
C---SET FLAG TO NOT PAUSE AFTER LEZSHW.
CALL LEZOPT ('PAUSE',.FALSE.)

```

C---SHOW GRAPH---

```
CALL LEZSHW
```

C--- RE-INITIALIZE CGL AND DI-3000 ---

```

IDEV=0
CALL LEZINI (IDEV)

```

C---SET UP BAR GRAPH---

```

NVALS = 7
TITLE = ' '
IAXLBL = 'T[BLC]EMPERATURE, [BSUP]O[ESUP][ELC]C'
DAXLBL = ' '
INDMIN = -40.
INDMAX = 40.
DEPMIN = 250.
DEPMAX = 450.
INDHV = 1
IBRAPP = 1
CALL LEZBAR (CELS,PRESS,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+
DEPMIN,DEPMAX,INDHV,IBRAPP)

```

C---CREATE A NUMERIC AXIS---

```
IHV=2
NDEC=-3
TSTART=DEPMIN
TINCR=100.
TEND=DEPMAX
NTMINR=9
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)
```

C---SET OPTIONS---

```
C---CHANGE LENGTH OF HORIZONTAL AXIS.
      CALL LEZOPT ('HAXLEN',5.0)
C---CHANGE LENGTH OF VERTICAL AXIS.
      CALL LEZOPT ('VAXLEN',1.5)
C---CHANGE X COORDINATE OF ORIGIN.
      CALL LEZOPT ('XORIGIN',1.75)
C---CHANGE Y COORDINATE OF ORIGIN.
      CALL LEZOPT ('YORIGIN',4.75)
C---SET FLAG TO NOT CLEAR SCREEN AFTER LEZSHW.
      CALL LEZOPT ('CLEAR',.FALSE.)
C---SET FLAG TO NOT PAUSE AFTER LEZSHW.
      CALL LEZOPT ('PAUSE',.FALSE.)
```

C---SHOW GRAPH---

```
      CALL LEZSHW
```

C--- RE-INITIALIZE CGL AND DI-3000 ---

```
      IDEV=0
      CALL LEZINI (IDEV)
```

C---SET UP LINE GRAPH---

```
      NVALS = 11
      TITLE = ' '
      IAXLBL = 'E[BLC]NTROPY, [ELC]S, J/[BLC]MOL AT 1 ATMOS'
      DAXLBL = ' '
      INDMIN =0.0
      INDMAX = 10.
      DEPMIN = 10.
      DEPMAX = 110.
      INDHV = 1
      LINAPP = 1
      CALL LEZLIN (ENTRPY,KELVN,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+                DEPMIN,DEPMAX,INDHV,LINAPP)
```

C---CREATE A NUMERIC AXIS---

```
IHV=2
NDEC=-2
```

```

TSTART=DEPMIN
TINCR=20.
TEND=DEPMAX
NTMINR=1
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

```

C---SET OPTIONS FOR LINE GRAPH---

```

C---CHANGE X COORDINATE OF ORIGIN.
CALL LEZOPT ('XORIGIN',1.75)
C---CHANGE Y COORDINATE OF ORIGIN.
CALL LEZOPT ('YORIGIN',1.75)
C---CHANGE LENGTH OF HORIZONTAL AXIS.
CALL LEZOPT ('HAXLEN',5.0)
C---CHANGE LENGTH OF VERTICAL AXIS.
CALL LEZOPT ('VAXLEN',1.5)

```

C---PLACE NOTES ON PAGE---

```

STRING = '[BLC]A) [ELC]C[BLC]OMPOSITION OF [ELC]S[BLC]UPERALLOY'
XPOS = 3.5
YPOS = 6.5
IHJST = 2
IVJST = 1
IANG = 0
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

```

```

STRING = '[BLC]B) [ELC]L[BLC]OW PRESSURE FATIGUE OF [ELC]S[BLC]UPE
+RALLOY'
YPOS = 3.65
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

```

```

STRING = '[BLC]C) [ELC]T[BLC]EMPERATURE VS. ENTROPY FOR [ELC]S[BLC]
+UPERALLOY'
YPOS = .65
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

```

```

STRING = 'F[BLC]IGURE NUM. [ELC]C[BLC]HARACTERISTIC CHARTS FOR [EL
+C]S[BLC]UPERALLOY'
YPOS = 0.0
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

```

```

STRING = 'P[BLC]RESSURE'
XPOS = .5
YPOS = 5.75
IHJST = 2
IVJST = 3
IANG = 0
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

```

```

STRING = '[BLC]AT FAILURE,'
YPOS = 5.5
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

```

```

STRING = '[BLC]PASCALS'
YPOS = 5.25
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

STRING = '[BLC]TEMPERATURE,'
YPOS = 2.75
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

STRING = 'K'
YPOS = 2.5
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

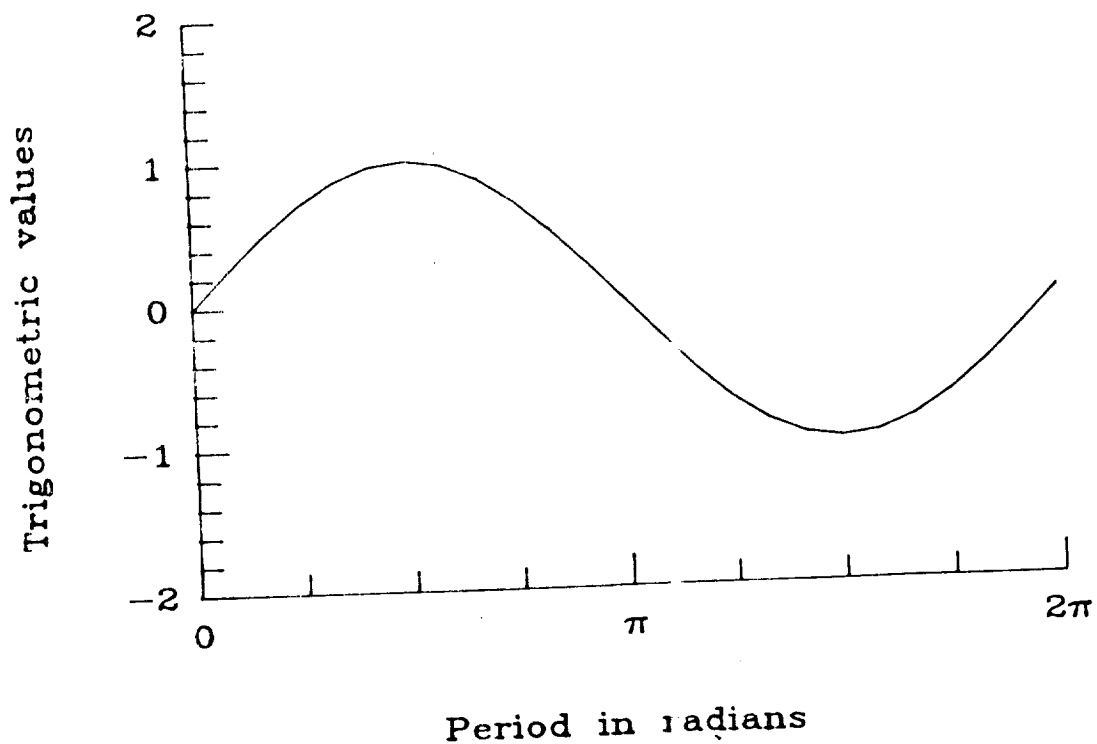
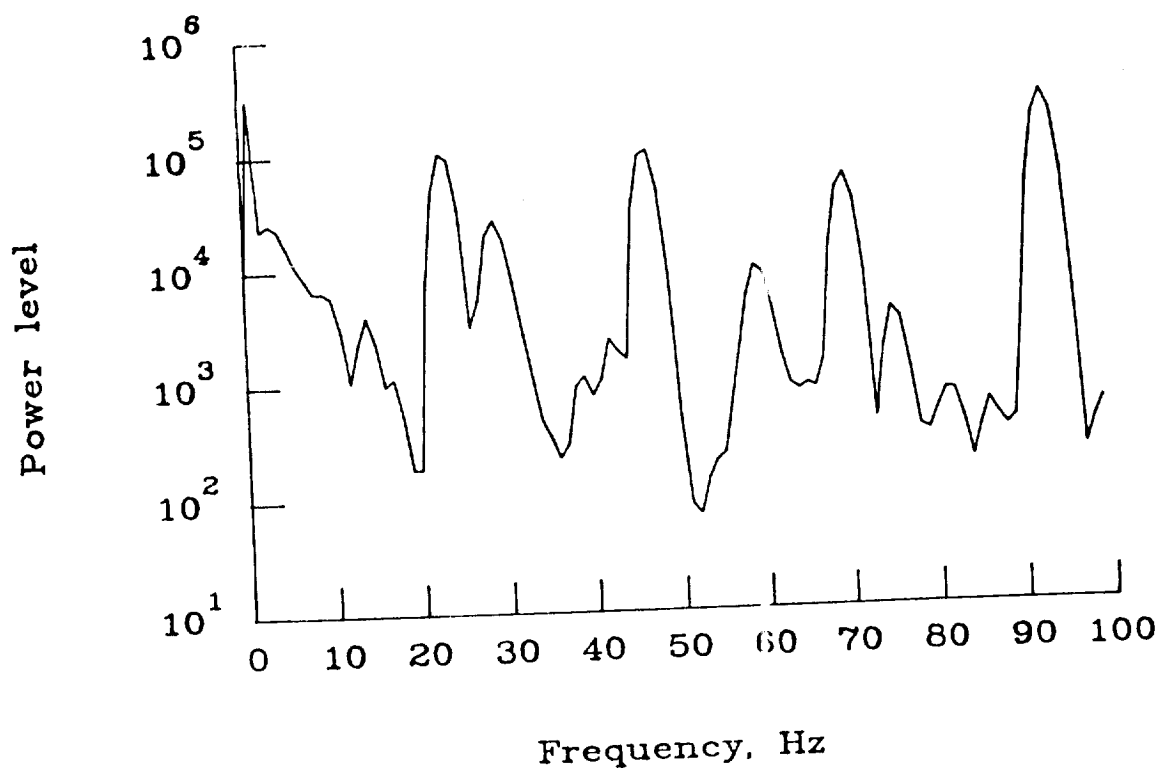
CALL LEZNOT ('CGMIX1',7.0,0.0,3,1,0)
C---SHOW GRAPH---

CALL LEZSHW

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

CALL LEZTRM
RETURN
END

```

CGMLX2

PROGRAM CGMIX2

```

C-----
C
C THIS EXAMPLE DRAWS A COMPOSITE CHART WITH A LINEAR AND A LOG BASE 10
C CHART
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C     NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C         TSTART - FIRST MAJOR TICK MARK VALUE,
C         TINC - MAJOR TICK MARK INCREMENT,
C         TEND - LAST MAJOR TICK MARK VALUE,
C         NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZAXT (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         NLABS - NUMBER OF TICK MARK LABELS IN STRING,
C         LABELS - TICK MARK LABELS,
C         NTMAJR - NUMBER OF MAJOR TICK MARKS,
C         NTMINR - NUMBER OF MINOR TICK MARK PER INCREMENT)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C         O:METAFILE 1:SCREEN 2:BOTH)
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA PAIRS,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT AXIS MINIMUM,
C         INDMAX - INDEPENDENT AXIS MAXIMUM,
C         DEPMIN - DEPENDENT AXIS MINIMUM,
C         DEPMAX - DEPENDENT AXIS MAXIMUM,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C         LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C
C LEZLOG (INDARY - INDEPENDENT DATA SET,
C         DEPARY - DEPENDENT DATA SET,
C         NVALS - NUMBER OF DATA VALUES,
C         TITLE - TITLE OF GRAPH,
C         IAXLBL - INDEPENDENT AXIS LABEL,
C         DAXLBL - DEPENDENT AXIS LABEL,
C         INDMIN - INDEPENDENT AXIS MINIMUM,
C         INDMAX - INDEPENDENT AXIS MAXIMUM,
C         DEPMIN - DEPENDENT AXIS MINIMUM,
C         DEPMAX - DEPENDENT AXIS MAXIMUM,
C         IAXTYP - DETERMINE AXIS TYPE 1:LOG IND 2:LOG DEP 3:LOG BOTH,
C         IHLOGI - HORIZONTAL AXIS TICK MARK LABEL TYPE,
C         IVLOGI - VERTICAL AXIS TICK MARK LABEL TYPE,
C         INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,

```

```

C          LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C
C LEZOPT (OPTION - OPTION NAME,
C          IVALS - OPTION VALUE(S))
C
C LEZPGE (XVAL - WIDTH OF DESIRED PAGE,
C          YVAL - HEIGHT OF DESIRED PAGE)
C
C LEZSHW
C
C LEZTRM
C
C-----

```

C---DATA SECTION---

```

          CHARACTER*80 TITLE, IAXLBL, DAXLBL, LABELS
          REAL FREQ(100), POWER(100), INDMIN, INDMAX
          REAL PI(25), SSIN(25)
          DATA (POWER(I), I=1, 76)/
+ 7066.0770323, 313987.5856597, 23005.34014683, 25971.13637497,
+ 23314.47811626, 16222.72126064, 11123.46224798, 8573.673551723,
+ 6533.280733426, 6567.484820724, 5931.92717933, 3100.185764845,
+ 1075.542233512, 2304.552081512, 3938.878376374, 2372.668800947,
+ 990.5827153465, 1139.692923046, 539.1035104119, 186.2399260743,
+ 185.9121866205, 6922.275564162, 47871.80671708, 101610.8109471,
+ 90151.05656181, 32565.81919631, 3126.25985372, 5378.883275207,
+ 19139.27829711, 26311.51279586, 18051.10302768, 7595.925085295,
+ 2769.064915013, 1114.906853713, 472.3435990609, 336.5553643497,
+ 224.6112529072, 292.8078714839, 913.1650006148, 1111.290988571,
+ 763.2538952391, 1036.757022708, 2318.840862193, 1815.115702427,
+ 1546.468077257, 30998.79018191, 90446.39960755, 99542.65318885,
+ 46517.56984878, 8264.407149583, 477.4873134733, 82.183079214,
+ 67.7501808438, 136.6466583528, 197.6147132091, 229.3505457034,
+ 643.2165902202, 1824.921600301, 5246.018888617, 9355.942325835,
+ 8240.202957789, 4042.516486596, 1615.454279283, 876.7523693048,
+ 780.321551955, 869.2380712535, 806.9102907816, 1417.485863451,
+ 13314.08558278, 42705.82833591, 56933.22987158, 34522.64829539,
+ 8369.70034301, 423.4410260173, 1721.308093883, 3815.021552281/
          DATA (POWER(I), I=77, 100)/
+ 3096.896818539, 1130.33337685, 351.6629052997, 323.9146852672,
+ 496.8216394068, 716.3789266813, 707.1830537755, 395.452882063,
+ 185.9595078555, 349.7278623283, 579.1256929328, 427.7957796537,
+ 339.4866401359, 404.7726592585, 3303.494231505, 44732.3344563,
+ 168132.2764905, 259620.2781873, 179647.069922, 51634.19154093,
+ 4701.338454798, 220.74733211, 377.2257021375, 552.6383507909/

          DO 1 I=1, 100
          RI=I
          FREQ(I)=RI-1.
1          POWER(I)=LOG10(POWER(I))

```

C---SET UP DESIRED PAGE---

```

XVAL=7.0
YVAL=9.0
CALL LEZPGE (XVAL,YVAL)

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

IDEV=2
CALL LEZINI(IDEV)

C---SET UP A LOG PLOT, INCOMING DATA HAS BEEN CONVERTED---

NVALS=100
TITLE=' '
IAXLBL='F[BLC]REQUENCY, [ELC]H[BLC]Z'
DAXLBL='P[BLC]OWER LEVEL'
INDMIN=0.0
INDMAX=0.0
DEPMIN=0.0
DEPMAX=0.0
IAXTYP=2
IHLOGI=0
IVLOGI=0
INDHV=1
LINAPP=1
CALL LEZLOG(FREQ,POWER,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+DEPMIN,DEPMAX,IAXTYP,IHLOGI,IVLOGI,INDHV,LINAPP)

C---CREATE AN INTEGER AXIS---

IHV=1
I3=-3
NDEC=I3
TSTART=0.0
TINCR=10.0
TEND=100.0
NTMINR=1
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

C---SET OPTIONS---

C---CHANGE LENGTH OF HORIZONTAL AXIS.
CALL LEZOPT ('HAXLEN',4.5)
C---CHANGE LENGTH OF VERTICAL AXIS.
CALL LEZOPT ('VAXLEN',3.0)
C---CHANGE X COORDINATE OF ORIGIN.
CALL LEZOPT ('XORIGIN',1.25)
C---CHANGE Y COORDINATE OF ORIGIN.
CALL LEZOPT ('YORIGIN',5.75)
C---SET FLAG TO NOT CLEAR SCREEN AFTER LEZSHW.
CALL LEZOPT ('CLEAR',.FALSE.)
C---SET FLAG TO NOT PAUSE AFTER LEZSHW.
CALL LEZOPT ('PAUSE',.FALSE.)

CALL LEZNOT('CGMIX2',7.,0.,3,1,0)

```

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OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

C---SHOW GRAPH---

```
CALL LEZSHW

WPI=ACOS(-1.)
DO 10 I=1,25
  RI=I
  PI(I)=(RI-1.)*(WPI/12.)
  SSIN(I)=SIN(PI(I))
10  CONTINUE
```

C---RE-INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```
IDEV=2
CALL LEZINI(IDEV)
```

C---SET UP A LINE PLOT

```
NVALS=25
TITLE=' '
IAXLBL='P[BLC]ERIOD IN RADIANS'
DAXLBL='T[BLC]RIGONOMETRIC VALUES'
INDMIN=PI(1)
INDMAX=PI(25)
DEPMIN=-2.0
DEPMAX=2.0
INDHV=1
LINAPP=1
CALL LEZLIN(PI,SSIN,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,
+INDMAX,DEPMIN,DEPMAX,INDHV,LINAPP)
```

C---CREATE A CHARACTER AXIS---

```
IHV=1
NLABS=3
LABELS='Q$[FONT=9][BLC]Q$2[FONT=9][BLC]Q$'
NTMAJR=3
NTMINR=3
CALL LEZAXT(IHV,NLABS,LABELS,NTMAJR,NTMINR)
```

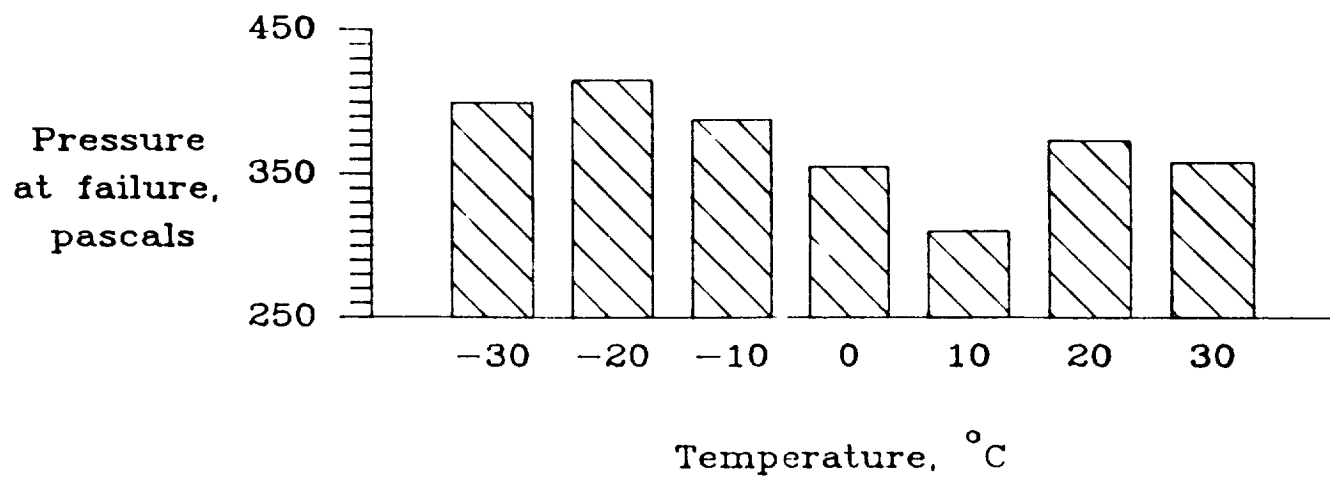
C---CREATE A NUMERIC AXIS---

```
IHV=2
NDEC=-1
TSTART=-2.0
TINCR=1.0
TEND=2.0
NTMINR=4
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)
```

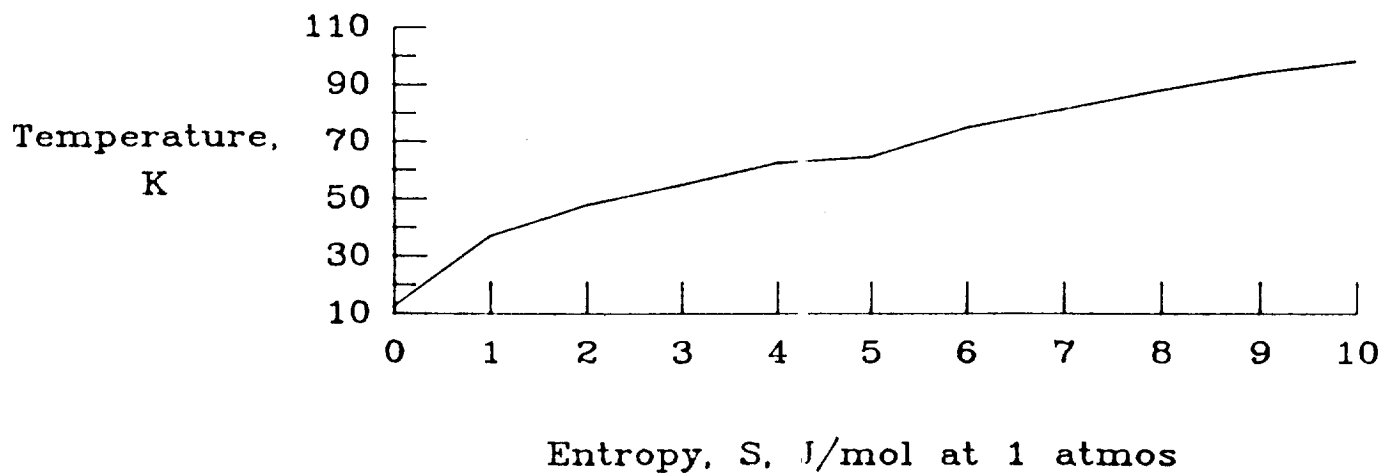
C---SET OPTIONS---

```
C---CHANGE LENGTH OF HORIZONTAL AXIS
CALL LEZOPT('HAXLEN',4.5)
```

```
C---CHANGE LENGTH OF VERTICAL AXIS.  
      CALL LEZOPT ('VAXLEN',3.0)  
C---CHANGE X COORDINATE OF ORIGIN.  
      CALL LEZOPT ('XORIGIN',1.25)  
C---CHANGE Y COORDINATE OF ORIGIN.  
      CALL LEZOPT ('YORIGIN',1.0)  
  
C---SHOW GRAPH---  
  
      CALL LEZSHW  
  
C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---  
  
      CALL LEZTRM  
      STOP  
      END
```



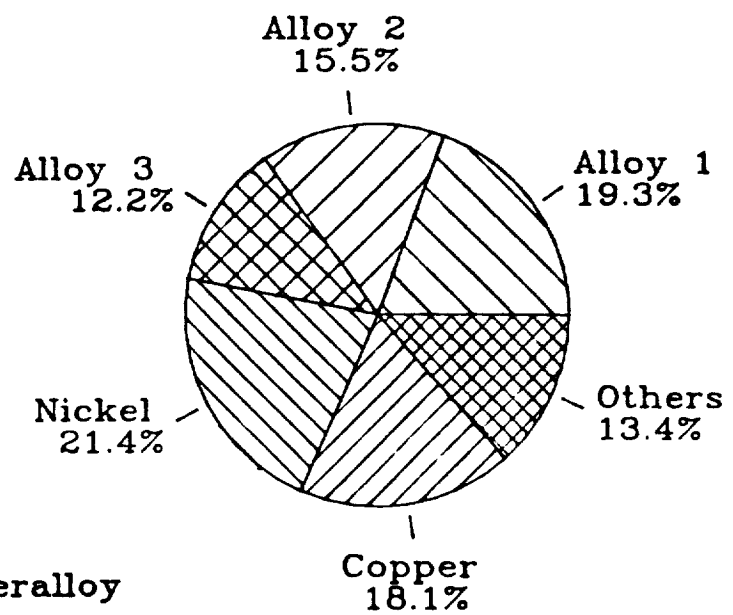
a) Low pressure fatigue of Superalloy



b) Temperature vs. entropy for Superalloy

This figure is intentionally not centered.

The position of this figure is determined by the following program.



c) Composition of Superalloy

Figure num. Concluded

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OF POOR QUALITY

PROGRAM CGMIX3

```
C-----
C
C THIS EXAMPLE DRAWS A LINE, A BAR, AND A PIE CHART ON ONE PAGE.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C   (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C   NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZAXN (IHV - AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C   NDEC - NUMBER OF DIGITS FOR TICK MARK LABELS,
C   TSTART - FIRST MAJOR TICK MARK VALUE,
C   TINC - MAJOR TICK MARK INCREMENT,
C   TEND - LAST MAJOR TICK MARK VALUE,
C   NTMINR - NUMBER OF MINOR TICK MARKS PER INCREMENT)
C
C LEZBAR (INDARY - INDEPENDENT DATA SET,
C   DEPARY - DEPENDENT DATA SET,
C   NVALS - NUMBER OF DATA VALUES,
C   TITLE - TITLE OF GRAPH,
C   IAXLBL - INDEPENDENT AXIS LABEL,
C   DAXLBL - DEPENDENT AXIS LABEL,
C   INDMIN - INDEPENDENT DATA MINIMUM,
C   INDMAX - INDEPENDENT DATA MAXIMUM,
C   DEPMIN - DEPENDENT DATA MINIMUM,
C   DEPMAX - DEPENDENT DATA MAXIMUM,
C   INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C   IBRAPP - APPEARANCE INDICATOR 0:UNFILLED 1:FILLED)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C   0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZLIN (INDARY - INDEPENDENT DATA SET,
C   DEPARY - DEPENDENT DATA SET,
C   NVALS - NUMBER OF DATA PAIRS,
C   TITLE - TITLE OF GRAPH,
C   IAXLBL - INDEPENDENT AXIS LABEL,
C   DAXLBL - DEPENDENT AXIS LABEL,
C   INDMIN - INDEPENDENT AXIS MINIMUM,
C   INDMAX - INDEPENDENT AXIS MAXIMUM,
C   DEPMIN - DEPENDENT AXIS MINIMUM,
C   DEPMAX - DEPENDENT AXIS MAXIMUM,
C   INDHV - INDEPENDENT AXIS INDICATOR 1:HORIZONTAL 2:VERTICAL,
C   LINAPP - APPEARANCE INDICATOR 1:LINE 2:MARKER 3:BOTH)
C
C LEZNOT (STRING - NOTE,
C   XPOS - X POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C   YPOS - Y POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C   IHJST - HORIZONTAL JUSTIFICATION 1:LEFT 2:CENTER 3:RIGHT,
C   IVJST - VERTICAL JUSTIFICATION 1:BOTTOM 2:CENTER 3:TOP,
C   IANG - ANGLE OF ROTATION ABOUT THE JUSTIFICATION POINT)
C   ANGLE OF ROTATION IS MEASURED COUNTERCLOCKWISE
C   FROM THE HORIZONTAL AXIS.
```

```

C
C LEZOPT (IOPT - OPTION NUMBER,
C         IVALS - OPTION VALUE(S))
C
C LEZPIE (SEGS - DATA SET,
C         NUM - NUMBER OF DATA VALUES,
C         TITLE - TITLE OF GRAPH,
C         NEXP1 - NUMBER OF FIRST EXPLODED SEGMENT,
C         NEXP2 - NUMBER OF LAST EXPLODED SEGMENT,
C         LFORM1 - QUANTITY LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY,
C         LFORM2 -PERCENTAGE LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY)
C
C LEZPGE (XVAL - WIDTH OF DESIRED PAGE,
C         YVAL - HEIGHT OF DESIRED PAGE)
C
C LEZPLB (NOPLB - SEGMENT NUMBER ASSOCIATED WITH LABEL,
C         LABEL - SEGMENT LABELS,
C         KEY - KEY ENTRY LABEL FOR THIS SEGMENT)
C
C LEZSHW
C
C LEZTRM
C
C-----

```

C---DATA SECTION---

```

      REAL  INDMAX, INDMIN
      REAL COMP(6),CELS(7),PRESS(7),ENTRPY(11),KELVN(11)

      CHARACTER*80 TITLE,STRING,LABEL,IAXLBL,DAXLBL,KEY

      DATA COMP/4.6,3.7,2.9,5.1,4.3,3.2/
      DATA CELS/-30.,-20.,-10.,0.,10.,20.,30./
      DATA PRESS/400.,415.8,388.2,355.3,310.6,373.7,358.4/
      DATA ENTRPY/0.,1.,2.,3.,4.,5.,6.,7.,8.,9.,10./
      DATA KELVN/12.6,37.2,48.,55.,62.4,64.4,74.8,81.3,88.1,94.1,98.3/

```

C---SET UP NON-DEFAULT PAGE SIZE---

```

      XVAL=7.0
      YVAL=9.0
      CALL LEZPGE (XVAL,YVAL)

```

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

      IDEV = 0
      CALL LEZINI (IDEV)

```

C---SET UP BAR GRAPH---

```

      NVALS = 7
      TITLE = ' '
      IAXLBL = 'T[BLC]EMPERATURE, [BSUP]O[ESUP][ELC]C'

```

```

DAXLBL = ' '
INDMIN = -40.
INDMAX = 40.
DEPMIN = 250.
DEPMAX = 450.
INDHV = 1
IBRAPP = 1
CALL LEZBAR (CELS,PRESS,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+           DEPMIN,DEPMAX,INDHV,IBRAPP)

C---CREATE A NUMERIC AXIS---

IHV=2
NDEC=-3
TSTART=DEPMIN
TINCR=100.
TEND=DEPMAX
NTMINR=9
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

C---SET OPTIONS---

C---CHANGE LENGTH OF HORIZONTAL AXIS.
CALL LEZOPT ('HAXLEN',5.0)
C---CHANGE LENGTH OF VERTICAL AXIS.
CALL LEZOPT ('VAXLEN',1.5)
C---CHANGE X COORDINATE OF ORIGIN.
CALL LEZOPT ('XORIGIN',1.75)
C---CHANGE Y COORDINATE OF ORIGIN.
CALL LEZOPT ('YORIGIN',6.)
C---SET FLAG TO NOT CLEAR SCREEN AFTER LEZSHW.
CALL LEZOPT ('CLEAR',.FALSE.)
C---SET FLAG TO NOT PAUSE AFTER LEZSHW.
CALL LEZOPT ('PAUSE',.FALSE.)

C---SHOW GRAPH---

CALL LEZSHW

C--- RE-INITIALIZE CGL AND DI-3000 ---

IDEV=0
CALL LEZINI (IDEV)

C---SET UP LINE GRAPH---

NVALS = 11
TITLE = ' '
IAXLBL = 'E[BLC]NTROPY, [ELC]S. J/[BLC]MOL AT 1 ATMOS'
DAXLBL = ' '
INDMIN = 0.0
INDMAX = 10.
DEPMIN = 10.
DEPMAX = 110.

```

```

INDHV = 1
LINAPP = 1
CALL LEZLIN (ENTRPN,KELVN,NVALS,TITLE,IAXLBL,DAXLBL,INDMIN,INDMAX,
+           DEPMIN,DEPMAX,INDHV,LINAPP)

```

C---CREATE A NUMERIC AXIS---

```

IHV=2
NDEC=-2
TSTART=DEPMIN
TINCR=20.
TEND=DEPMAX
NTMINR=1
CALL LEZAXN(IHV,NDEC,TSTART,TINCR,TEND,NTMINR)

```

C---SET OPTIONS FOR LINE GRAPH---

```

C---CHANGE X COORDINATE OF ORIGIN.
CALL LEZOPT ('XORIGIN',1.75)
C---CHANGE Y COORDINATE OF ORIGIN.
CALL LEZOPT ('YORIGIN',2.25)
C---CHANGE LENGTH OF HORIZONTAL AXIS.
CALL LEZOPT ('HAXLEN',5.0)
C---CHANGE LENGTH OF VERTICAL AXIS.
CALL LEZOPT ('VAXLEN',1.5)

```

C---PLACE NOTES ON PAGE---

```

STRING = '[BLC]A) [ELC]L[BLC]OW PRESSURE FATIGUE OF [ELC]S[BLC]UPE
+RALLY'
XPOS = 0.0
YPOS = 4.4
IHJST = 1
IVJST = 1
IANG = 0
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

STRING = '[BLC]B) [ELC]T[BLC]EMPERATURE VS. ENTROPY FOR [ELC]S[BLC]
+]UPERALLOY'
YPOS = .65
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

STRING = 'F[BLC]IGURE NUM. [ELC]C[BLC]HARACTERISTIC CHARTS FOR [EL
+C]S[BLC]UPERALLOY'
YPOS = 0.0
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

STRING = 'P[BLC]RESSURE'
XPOS = .5
YPOS = 7.
IHJST = 2
IVJST = 3
IANG = 0
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

```

ORIGINAL PAGE IS
OF POOR QUALITY

```
STRING = '[BLC]AT FAILURE,'  
YPOS = 6.75  
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)
```

```
STRING = '[BLC]PASCALS'  
YPOS = 6.5  
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)
```

```
STRING = 'T[BLC]TEMPERATURE,'  
YPOS = 3.25  
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)
```

```
STRING = 'K'  
YPOS = 3.0  
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)
```

```
CALL LEZNOT ('CGMIX3',7.0,0.0,1,0)
```

C---SHOW GRAPH---

```
CALL LEZSHW
```

C--- RE-INITIALIZE CGL AND DI-3000 ---

```
IDEV=0  
CALL LEZINI (IDEV)
```

C---SET UP PIE GRAPH---

```
NUM = 6  
TITLE = '  
NEXP1 = 0  
NEXP2 = 0  
LFORM1 = 0  
LFORM2 = 1  
CALL LEZPIE (COMP,NUM,TITLE,NEXP1,NEXP2,LFORM1,LFORM2)
```

C ---MAKE KEY ENTRIES---

```
NOPLB = 1  
LABEL = 'A[BLC]LLOY 1'  
KEY = '  
CALL LEZPLB (NOPLB,LABEL,KEY)  
CALL LEZPLB (2,'A[BLC]LLOY 2', '  
CALL LEZPLB (3,'A[BLC]LLOY 3', '  
CALL LEZPLB (4,'N[BLC]ICKEL', '  
CALL LEZPLB (5,'C[BLC]OPPER', '  
CALL LEZPLB (6,'O[BLC]THERS', '  
'
```

C ---SET OPTIONS---

```
C ---CHANGE RADIUS OF PIE.  
CALL LEZOPT ('RADIUS',1.)
```

```
C ---CHANGE X COORDINATE OF ORIGIN.  
      CALL LEZOPT ('XORIGIN',3.5)  
C ---CHANGE Y COORDINATE OF ORIGIN.  
      CALL LEZOPT ('YORIGIN',3.0)
```

```
C---PLACE NOTES ON PAGE---
```

```
      STRING = '[BLC]C) [ELC]C[BLC]OMPOSITION OF [ELC]S[BLC]UPERALLOY'  
      XPOS = 0.0  
      YPOS = 1.  
      IHJST = 1  
      IVJST = 1  
      IANG = 0  
      CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IAN)
```

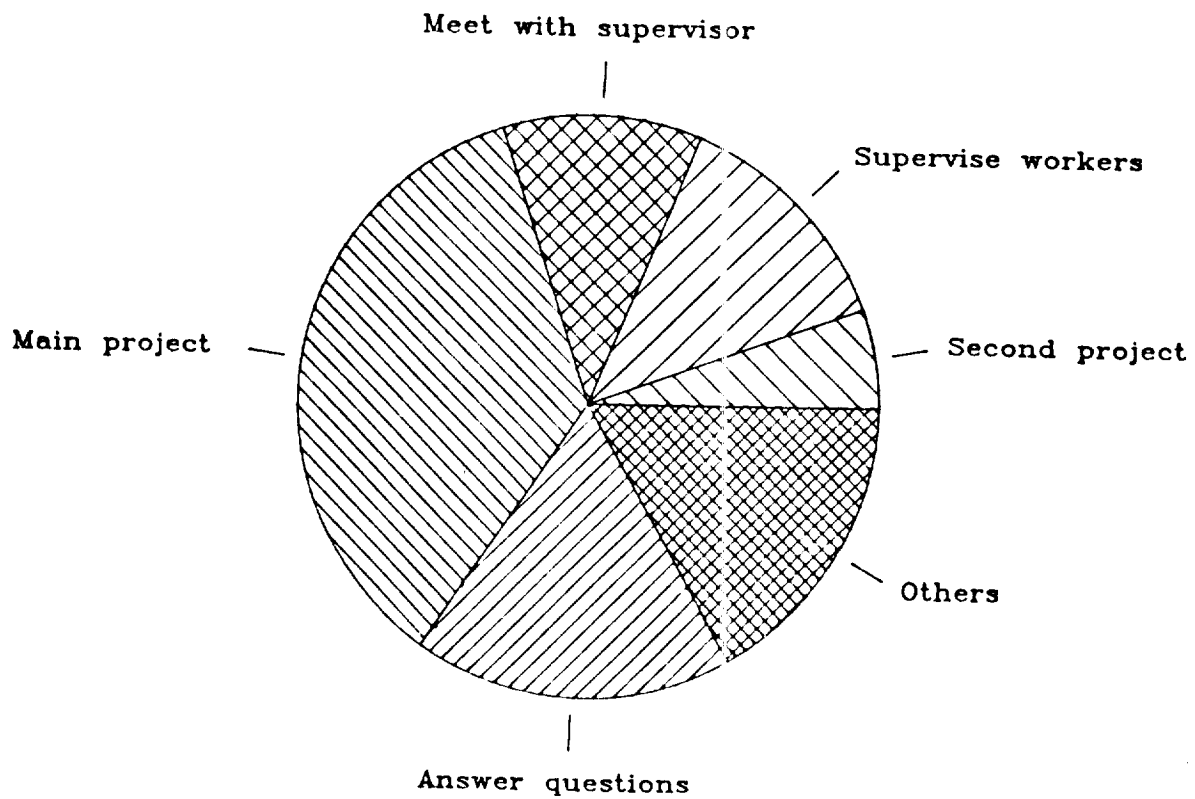
```
      STRING = 'F[BLC]IGURE NUM. [ELC]C[BLC]ONCLUDED'  
      XPOS = 3.5  
      IHJST = 2  
      YPOS = 0.0  
      CALL LEZNOT(STRING,XPOS,YPOS,IHJST,IVJST,IAN)
```

```
C---SHOW GRAPH---
```

```
      CALL LEZSHW
```

```
C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---
```

```
      CALL LEZTRM  
      RETURN  
      END
```



CGPIE1

PROGRAM CGPIE1

```

C-----
C
C THIS EXAMPLE DRAWS A SIMPLE PIE GRAPH
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C          0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZPIE (SEGS - DATA SET,
C          NUM - NUMBER OF DATA VALUES,
C          TITLE - TITLE OF GRAPH,
C          NEXP1 - NUMBER OF FIRST EXPLODED SEGMENT,
C          NEXP2 - NUMBER OF LAST EXPLODED SEGMENT,
C          LFORM1 - QUANTITY LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY,
C          LFORM2 -PERCENTAGE LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY)
C
C LEZPLB (NOPLB - SEGMENT NUMBER ASSOCIATED WITH LABEL,
C          LABEL - SEGMENT LABELS,
C          KEY - KEY ENTRY LABEL FOR THIS SEGMENT)
C
C LEZSHW
C
C LEZTRM
C-----

C---DATA SECTION---

      REAL SEGS(6)

      CHARACTER*80    TITLE,    LABEL,    KEY

      DATA SEGS/0.5, 1.2, 1.0, 3.2, 1.6, 1.5/

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

      IDEV = 2
      CALL LEZINI (IDEV)

C---SET UP PIE GRAPH AND LABELING---

      NUM = 6
      TITLE = 'D[BLC]AILY ACTIVITIES'
      NEXP1 = 0
      NEXP2 = 0
      LFORM1 = 0
      LFORM2 = 0
      CALL LEZPIE (SEGS,NUM,TITLE,NEXP1,NEXP2,LFORM1,LFORM2)

```


C---LABEL SEGMENTS---

```
NOPLB = 1
LABEL = 'S[BLC]ECOND PROJECT'
KEY = ' '
CALL LEZPLB (NOPLB,LABEL,KEY)
CALL LEZPLB (2,'S[BLC]UPERVISE WORKERS',' ')
CALL LEZPLB (3,'M[BLC]EET WITH SUPERVISOR',' ')
CALL LEZPLB (4,'M[BLC]AIN PROJECT',' ')
CALL LEZPLB (5,'A[BLC]NSWER QUESTIONS',' ')
CALL LEZPLB (6,'O[BLC]THERS',' ')
```

```
CALL LEZNOT('CGPIE1',7.,0.,3,1,0)
```

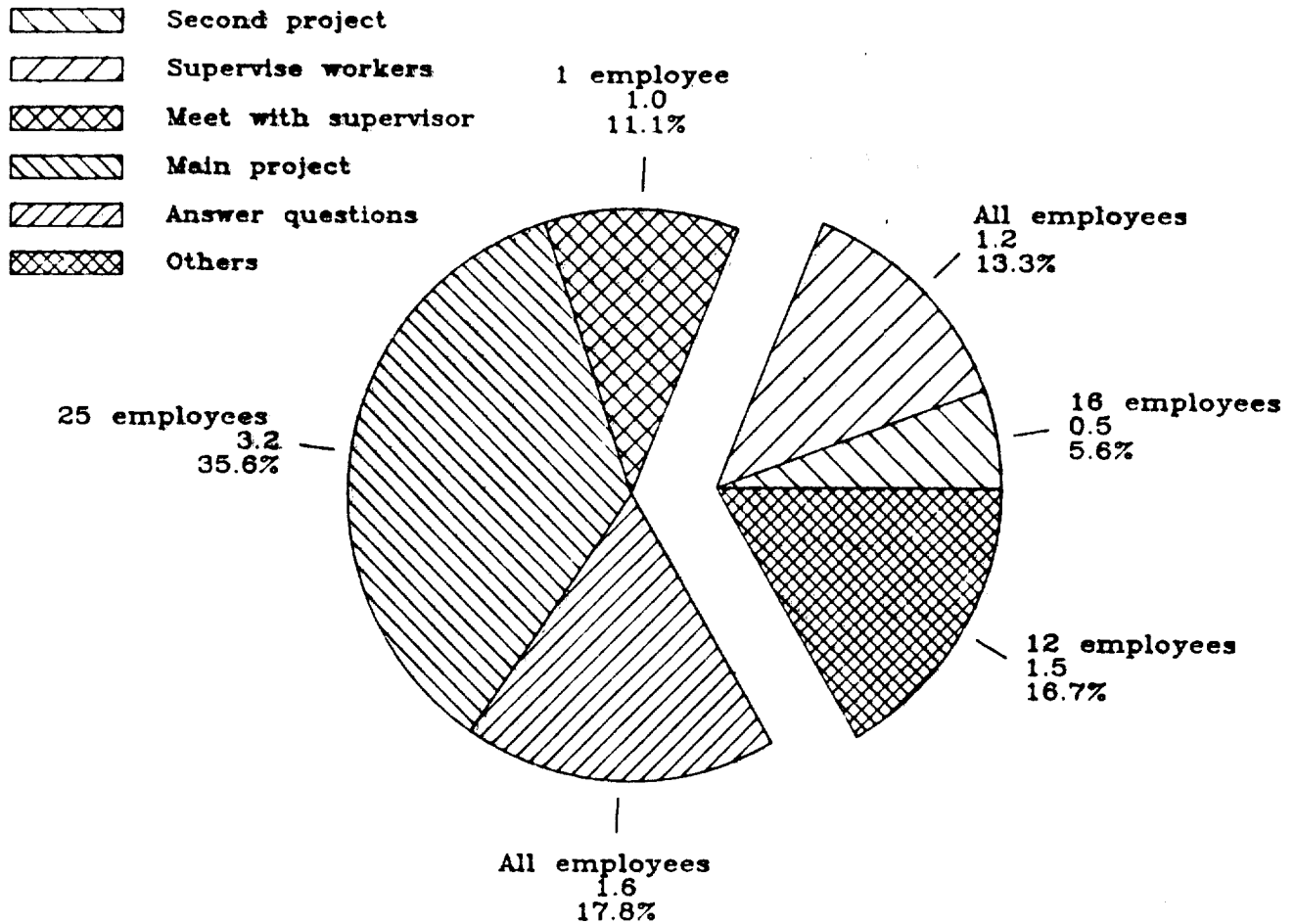
C---SHOW GRAPH---

```
CALL LEZSHW
```

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```
CALL LEZTRM
STOP
END
```

Daily activities



ORIGINAL PAGE 10
OF POOR QUALITY

CGPIE2

PROGRAM CGPIE2

```

C-----
C
C THIS EXAMPLE DRAWS AN EXPLODED PIE WITH A KEY
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C          0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZKEY (TITLE - TITLE OF GRAPH,
C          XPOS - X POSITION ON THE PAGE,
C          YPOS - Y POSITION ON THE PAGE,
C          KENTRY - FIRST KEY ENTRY LABEL)
C          KEY IS POSITIONED ACCORDING TO THE UPPER RIGHT CORNER
C
C LEZNOT (STRING - NOTE,
C          XPOS - X POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C          YPOS - Y POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C          IHJST - HORIZONTAL JUSTIFICATION 1:LEFT 2:CENTER 3:RIGHT,
C          IVJST - VERTICAL JUSTIFICATION 1:BOTTOM 2:CENTER 3:TOP,
C          IANG - ANGLE OF ROTATION ABOUT THE JUSTIFICATION POINT)
C          ANGLE OF ROTATION IS MEASURED COUNTERCLOCKWISE
C          FROM THE HORIZONTAL AXIS.
C
C LEZPIE (SEGS - DATA SET,
C          NUM - NUMBER OF DATA VALUES,
C          TITLE - TITLE OF GRAPH,
C          NEXP1 - NUMBER OF FIRST EXPLODED SEGMENT,
C          NEXP2 - NUMBER OF LAST EXPLODED SEGMENT,
C          LFORM1 - QUANTITY LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY,
C          LFORM2 -PERCENTAGE LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY)
C
C LEZPLB (NOPLB - SEGMENT NUMBER ASSOCIATED WITH LABEL,
C          LABEL - SEGMENT LABELS,
C          KEY - KEY ENTRY LABEL FOR THIS SEGMENT)
C
C LEZSHW
C
C LEZSIZ (XSIZE - WIDTH OF CHARACTERS,
C          YSIZE - HEIGHT OF CHARACTERS)
C
C LEZTRM
C-----
C---DATA SECTION---
      INTEGER IHJST, IVJST
      REAL SEGS(6)

```

```

CHARACTER*80    TITLE,    KENTRY,    STRING,    LABEL,    KEY

DATA SEGS/0.5, 1.2, 1.0, 3.2, 1.6, 1.5/

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

IDEV = 2
CALL LEZINI (IDEV)

C---SET UP PIE GRAPH AND LABELING---

TITLE = ' '
NUM = 6
NEXP1 = 6
NEXP2 = 2
LFORM1 = 1
LFORM2 = 1
CALL LEZPIE (SEGS,NUM,TITLE,NEXP1,NEXP2,LFORM1,LFORM2)

C---CREATE A KEY---

TITLE = ' '
XPOS = 3.0
YPOS = 6.25
KENTRY = 'S[BLC]ECOND PROJEKT'
CALL LEZKEY (TITLE,XPOS,YPOS,KENTRY)

C---LABEL SEGMENTS AND MAKE KEY ENTRIES---

NOPLB = 4
LABEL = '[BLC]25 EMPLOYEES'
KEY = 'M[BLC]AIN PROJECT'
CALL LEZPLB (NOPLB,LABEL,KEY)
CALL LEZPLB (1,'[BLC]16 EMPLOYEES','S[BLC]ECOND PROJEKT')
CALL LEZPLB (6,'[BLC]12 EMPLOYEES','O[BLC]THERS')
CALL LEZPLB (2,'A[BLC]LL EMPLOYEES','S[BLC]UPERVISE WORKERS')
CALL LEZPLB (3,'[BLC]1 EMPLOYEE','M[BLC]EET WITH SUPERVISOR')
CALL LEZPLB (5,'A[BLC]LL EMPLOYEES','A[BLC]NSWER QUESTIONS')

C---CHANGE CHARACTER SIZE OF TEXT FOR NOTE---

XSIZE = 0.25
YSIZE = 0.25/.8
CALL LEZSIZ (XSIZE,YSIZE)

C---PUT NOTE ON PAGE---

STRING = 'D[BLC]AILY ACTIVITIES'
XPOS = 3.5
YPOS = 6.7
IHJST = 2
IVJST = 1
IANG = 0
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

```

C---CHANGE CHARACTER SIZE OF TEXT BACK TO DEFAULT SIZE---

XSIZE = 0.0

YSIZE = 0.0

CALL LEZSIZ (XSIZE,YSIZE)

CALL LEZNOT('CGPIE2',7.,0.,3,1,0)

C---SHOW GRAPH---

CALL LEZSHW

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

CALL LEZTRM

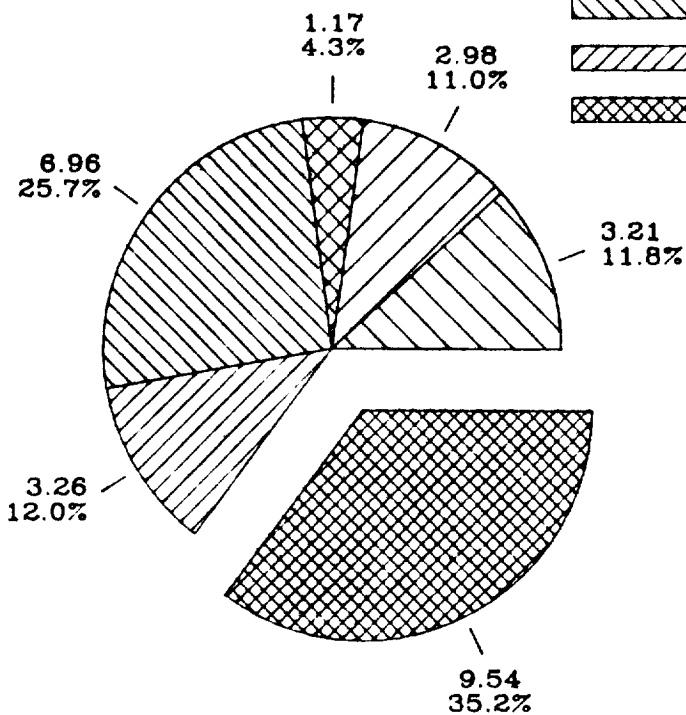
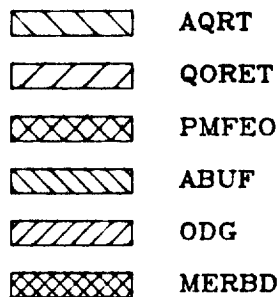
STOP

END

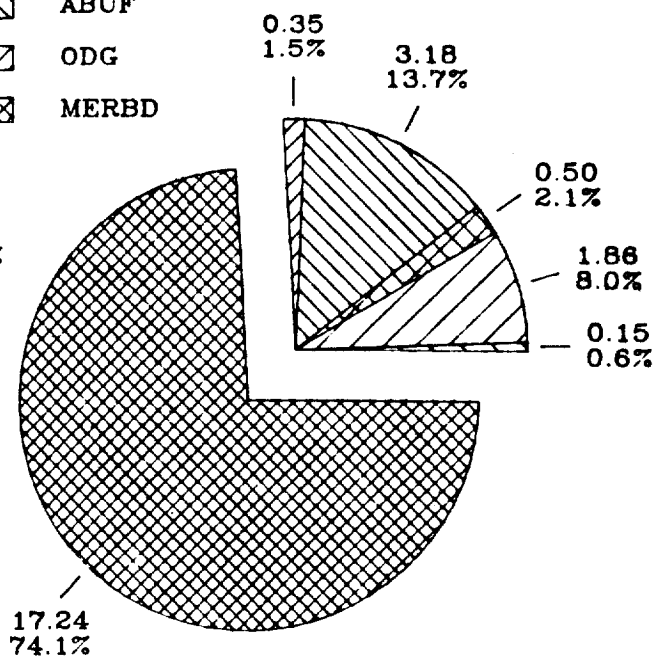
CRU utilization — Fiscal year 1986

CRUs (millions)

Divisions



Computer 1



Computer 2

CGPIE3

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PROGRAM CGPIE3

```

C-----
C
C THIS EXAMPLE DRAWS TWO EXPLODED PIE3 ON ONE PAGE WITH A KEY
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C          0:METAFILE 1:SCREEN 2:BOTH)
C
C LEZKEY (TITLE - TITLE OF GRAPH,
C          XPOS - X POSITION ON THE PAGE,
C          YPOS - Y POSITION ON THE PAGE,
C          KENTRY - FIRST KEY ENTRY LABEL)
C          KEY IS POSITIONED ACCORDING TO THE UPPER RIGHT CORNER
C
C LEZNOT (STRING - NOTE,
C          XPOS - X POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C          YPOS - Y POSITION OF THE JUSTIFICATION POINT ON THE PAGE,
C          IHJST - HORIZONTAL JUSTIFICATION 1:LEFT 2:CENTER 3:RIGHT,
C          IVJST - VERTICAL JUSTIFICATION 1:BOTTOM 2:CENTER 3:TOP,
C          IANG - ANGLE OF ROTATION ABOUT THE JUSTIFICATION POINT)
C          ANGLE OF ROTATION IS MEASURED COUNTERCLOCKWISE
C          FROM THE HORIZONTAL AXIS.
C
C LEZOPT (IOPT - OPTION NUMBER,
C          IVALS - OPTION VALUE(S))
C
C LEZPIE (SEGS - DATA SET,
C          NUM - NUMBER OF DATA VALUES,
C          TITLE - TITLE OF GRAPH,
C          NEXP1 - NUMBER OF FIRST EXPLODED SEGMENT,
C          NEXP2 - NUMBER OF LAST EXPLODED SEGMENT,
C          LFORM1 - QUANTITY LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY,
C          LFORM2 -PERCENTAGE LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY)
C
C LEZPLB (NOPLB - SEGMENT NUMBER ASSOCIATED WITH LABEL,
C          LABEL - SEGMENT LABELS,
C          KEY - KEY ENTRY LABEL FOR THIS SEGMENT)
C
C LEZPQP (N1 - TOTAL NUMBER OF CHARACTERS NEEDED FOR QUANTITY LABEL,
C          FORM1 - FORTRAN SPECIFICATION STATEMENT FOR QUANTITY LABELS,
C          N2 - TOTAL NUMBER OF CHARACTERS NEEDED FOR PERCENTAGE LABELS,
C          FORM2 - FORTRAN SPECIFICATION STATEMENT FOR PERCENTAGE LABELS)
C
C LEZSHW
C
C LEZSIZ (XSIZE - WIDTH OF CHARACTERS,
C          YSIZE - HEIGHT OF CHARACTERS)
C
C LEZTRM
C-----

```

C---DATA SECTION---

REAL PIEA(6), PIEB(6)

CHARACTER*80 KENTRY, FORM1, FORM2, TITLE, LABEL, KEY, STRING

DATA PIEA /3.21, 2.98, 1.17, 6.96, 3.26, 9.54/

DATA PIEB /.15, 1.86, .50, 3.18, .35, 17.24/

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

IDEV = 2

CALL LEZINI (IDEV)

C---SET UP FIRST PIE GRAPH AND LABELING---

TITLE = ' '

NUM = 6

NEXP1 = 6

NEXP2 = 6

LFORM1 = 1

LFORM2 = 1

CALL LEZPIE (PIEA,NUM,TITLE,NEXP1,NEXP2,LFORM1,LFORM2)

C---SPECIFY NON-DEFAULT FORMATS FOR QUANTITY AND PERCENT LABELS---

N1 = 3

FORM1 = '(F5.2)'

N2 = 5

FORM2 = '(F4.1,1H%)'

CALL LEZPQP(N1,FORM1,N2,FORM2)

C---SET OPTIONS---

C---CHANGE RADIUS OF PIE.

CALL LEZOPT ('RADIUS',1.2)

C---CHANGE X COORDINATE OF ORIGIN.

CALL LEZOPT ('XORIGIN',1.75)

C---CHANGE Y COORDINATE OF ORIGIN.

CALL LEZOPT ('YORIGIN',2.75)

C---SET FLAG SO SCREEN IS NOT CLEARED AFTER LEZSHW.

CALL LEZOPT ('CLEAR',.FALSE.)

C---SET FLAG SO THERE IS NOT PAUSE AFTER LEZSHW.

CALL LEZOPT ('PAUSE',.FALSE.)

C---PUT NOTE ON PAGE---

STRING = 'C[BLC]OMPUTER 1'

XPOS = 1.75

YPOS = 0.5

IHJST = 2

IVJST = 2

IANG = 0


```

        CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

        CALL LEZNOT('CGPIE3',7.,0.,3,1,0)
C---SHOW GRAPH---

        CALL LEZSHW

C---DRAW SECOND GRAPH ON PAGE---

C---SET UP SECOND PIE GRAPH AND LABELING---

        TITLE = ' '
        NUM = 6
        NEXP1 = 6
        NEXP2 = 6
        LFORM1 = 1
        LFORM2 = 1
        CALL LEZPIE (PIEB,NUM,TITLE,NEXP1,NEXP2,LFORM1,LFORM2)

C---CREATE A KEY---

        TITLE = 'D[BLC]IVISIONS'
        XPOS = 4.6
        YPOS = 6.0
        KENTRY = 'AQRT'
        CALL LEZKEY (TITLE,XPOS,YPOS,KENTRY)

C---DEFINE KEY ENTRIES---

        NOPLB = 2
        LABEL = ' '
        KEY = 'QORET'
        CALL LEZPLB (NOPLB,LABEL,KEY)
        CALL LEZPLB (3,' ', 'PMFEO')
        CALL LEZPLB (4,' ', 'ABUF')
        CALL LEZPLB (5,' ', 'ODG')
        CALL LEZPLB (6,' ', 'MERBD')

C---SPECIFY NON-DEFAULT FORMATS FOR QUANTITY AND PERCENT LABELS---

        N1 = 3
        FORM1 = '(F5.2)'
        N2 = 5
        FORM2 = '(F4.1,1H%)'
        CALL LEZPQP(N1,FORM1,N2,FORM2)

C---SET OPTION---

C---CHANGE X COODINATE OF ORIGIN.
        CALL LEZOPT ('XORIGIN',5.125)
C---SET FLAG SO THAT THE SCREEN PAUSES AFTER LEZSHW.
        CALL LEZOPT ('PAUSE',.TRUE.)

C---PUT NOTES ON PAGE---

```

```

STRING = 'C[BLC]OMPUTER 2'
XPOS = 5.125
YPOS = 0.5
IHJST = 2
IVJST = 2
IANG = 0
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

STRING = 'CRU[BLC]S (MILLIONS)'
XPOS = 3.5
YPOS = 6.25
IHJST = 2
IVJST = 2
IANG = 0
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

```

C---CHANGE CHARACTER SIZE OF TEXT FOR NOTE---

```

XSIZE = 0.2
YSIZE = 0.2/.8
CALL LEZSIZ (XSIZE,YSIZE)

```

C---PUT NOTE ON PAGE---

```

STRING = 'CRU[BLC] UTILIZATION[ELC] - F[BLC]ISCAL YEAR 1986'
XPOS = 3.5
YPOS = 6.5
IHJST = 2
IVJST = 2
IANG = 0
CALL LEZNOT (STRING,XPOS,YPOS,IHJST,IVJST,IANG)

```

C---CHANGE CHARACTER SIZE OF TEXT BACK TO DEFAULT SIZE---

```

XSIZE = 0.0
YSIZE = 0.0
CALL LEZSIZ (XSIZE,YSIZE)

```

C---SHOW GRAPH---

```

CALL LEZSHW

```

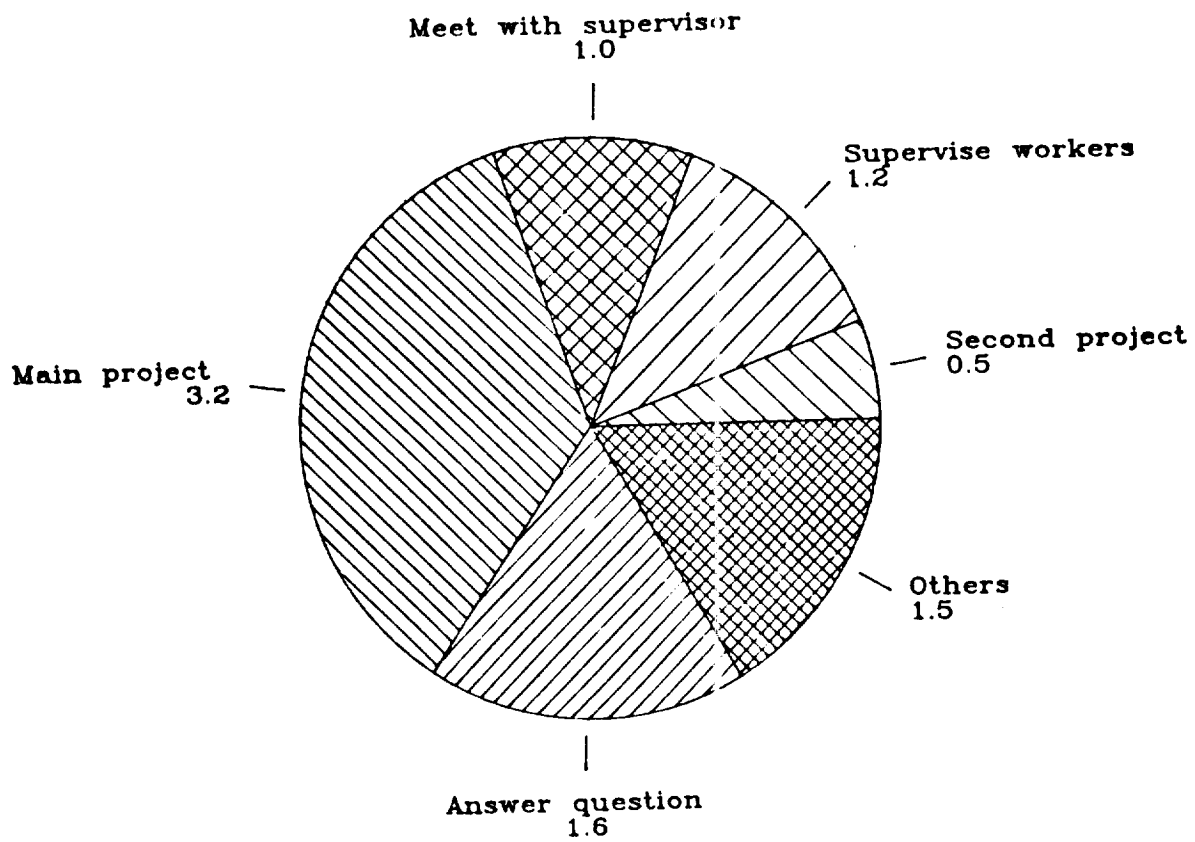
C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

CALL LEZTRM
STOP
END

```

ORIGINAL PAGE IS
OF POOR QUALITY



Daily activities

CGPIE4

PROGRAM CGPIE4

```

C-----
C
C THIS EXAMPLE DRAWS A PIE CHART WITH QUANTITY AND TEXT LABELS DISPLAYED
C FOR EACH SEGMENT.
C
C STRUCTURE OF COMMON GRAPHICS LIBRARY ROUTINES USED IN THIS EXAMPLE
C (THESE ROUTINES ARE LISTED IN ALPHABETICAL ORDER,
C NOT NECESSARILY IN THE ORDER THEY ARE USED!!!)
C
C LEZINI (IDEV - DI-3000 LOGICAL DEVICE NUMBER
C          O:METAFILE 1:SCREEN 2:BOTH)
C
C LEZPIE (SEGS - DATA SET,
C          NUM - NUMBER OF DATA VALUES,
C          TITLE - TITLE OF GRAPH,
C          NEXP1 - NUMBER OF FIRST EXPLODED SEGMENT,
C          NEXP2 - NUMBER OF LAST EXPLODED SEGMENT,
C          LFORM1 - QUANTITY LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY,
C          LFORM2 -PERCENTAGE LABEL INDICATOR 0:DO NOT DISPLAY 1:DISPLAY)
C
C LEZPLB (NOPLB - SEGMENT NUMBER ASSOCIATED WITH LABEL,
C          LABEL - SEGMENT LABELS,
C          KEY - KEY ENTRY LABEL FOR THIS SEGMENT)
C
C LEZSHW
C
C LEZTRM
C-----

```

C---DATA SECTION---

```

REAL SEGS(6)

CHARACTER*80  TITLE,  LABEL,  KEY

DATA SEGS/0.5, 1.2, 1.0, 3.2, 1.6, 1.5/

```

C---INITIALIZE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```

IDEV = 2
CALL LEZINI (IDEV)

```

C---SET UP PIE GRAPH AND LABELING---

```

NUM = 6
TITLE = 'D[BLC]AILY ACTIVITIES'
NEXP1 = 0
NEXP2 = 0
LFORM1 = 1
LFORM2 = 0
CALL LEZPIE (SEGS,NUM,TITLE,NEXP1,NEXP2,LFORM1,LFORM2)

```

C---LABEL SEGMENTS---

```
NOPLB = 1
LABEL = 'S[BLC]ECOND PROJECT'
KEY = ' '
CALL LEZPLB (NOPLB,LABEL,KEY)
CALL LEZPLB (2,'S[BLC]UPERVISE WORKERS',' ')
CALL LEZPLB (3,'M[BLC]EET WITH SUPERVISOR',' ')
CALL LEZPLB (4,'M[BLC]AIN PROJECT',' ')
CALL LEZPLB (5,'A[BLC]NSWER QUESTION',' ')
CALL LEZPLB (6,'O[BLC]THERS',' ')
```

```
CALL LEZNOT('CGPIE4',7.,0.,3,1,0)
```

C---SHOW GRAPH---

```
CALL LEZSHW
```

C---TERMINATE COMMON GRAPHICS LIBRARY AND DI-3000 ---

```
CALL LEZTRM
STOP
END
```

Notes.

APPENDIX C

DEFAULT CHARACTERISTICS USED IN THE COMMON GRAPHICS LIBRARY

The following figures illustrate the LEZ chart characteristics and their initial values. Many of these values can be changed after the CGL has been initialized. The values shown here are given to the characteristics at initialization and remain these values until they are overridden by calling the appropriate routines.

See the following tables for a complete list of LEZOPT options and their defaults:

Table 3-1 for the options for line and/or logarithmic charts,
Table 3-2 for the options for bar charts, and
Table 3-3 for the options for pie charts.

<u>Characteristic</u>	<u>Default Value</u>
1) <u>page coordinates</u> -	7 by 7 units (can be thought of as inches)
2) <u>axes length</u> : horizontal - vertical -	$\frac{2}{3} * \text{page width (HAXLEN)}$ $\frac{2}{3} * \text{page height (VAXLEN)}$
3) <u>origin of axes</u> : XORIGIN - YORIGIN -	$\frac{2}{9} * \text{page width}$ $\frac{2}{9} * \text{page height}$
4) <u>character size</u> : height - width -	$.129 (\text{CHEIGHT}) **$ $\frac{8}{10} * \text{character height (CWIDTH) **}$ Subscripts and superscripts are $\frac{8}{10} * \text{base}$ character height and width. **
5) <u>major tick mark length</u> -	CHEIGHT
6) <u>minor tick marks length</u> -	$\frac{2}{3} * \text{major tick mark length}$
7) <u>symbol size</u> -	same height and width as CHEIGHT
8) <u>distance from axis to tick mark label</u> -	$.063/.086 * \text{CHEIGHT **}$
9) <u>position of horizontal axis label</u> : X-position - Y-position -	$\text{XORIGIN} + \frac{1}{2} \text{HAXLEN}$ $.188/.086 * \text{CHEIGHT}$ from bottom of tick mark label **
10) <u>position of vertical axis</u> : X-position - Y-position -	$.188/.086 * \text{CWIDTH}$ from widest tick mark label ** $\text{YORIGIN} + \frac{1}{2} \text{VAXLEN}$
11) <u>position of caption</u> : X-position - Y-position -	$\text{XORIGIN} + \frac{1}{2} \text{HAXLEN}$ bottom of page + $2 * \text{CHEIGHT}$

** Scale factor used in this expression is a ratio of publication standard defaults.

The following figure illustrates the various defaults for the line and bar charts.

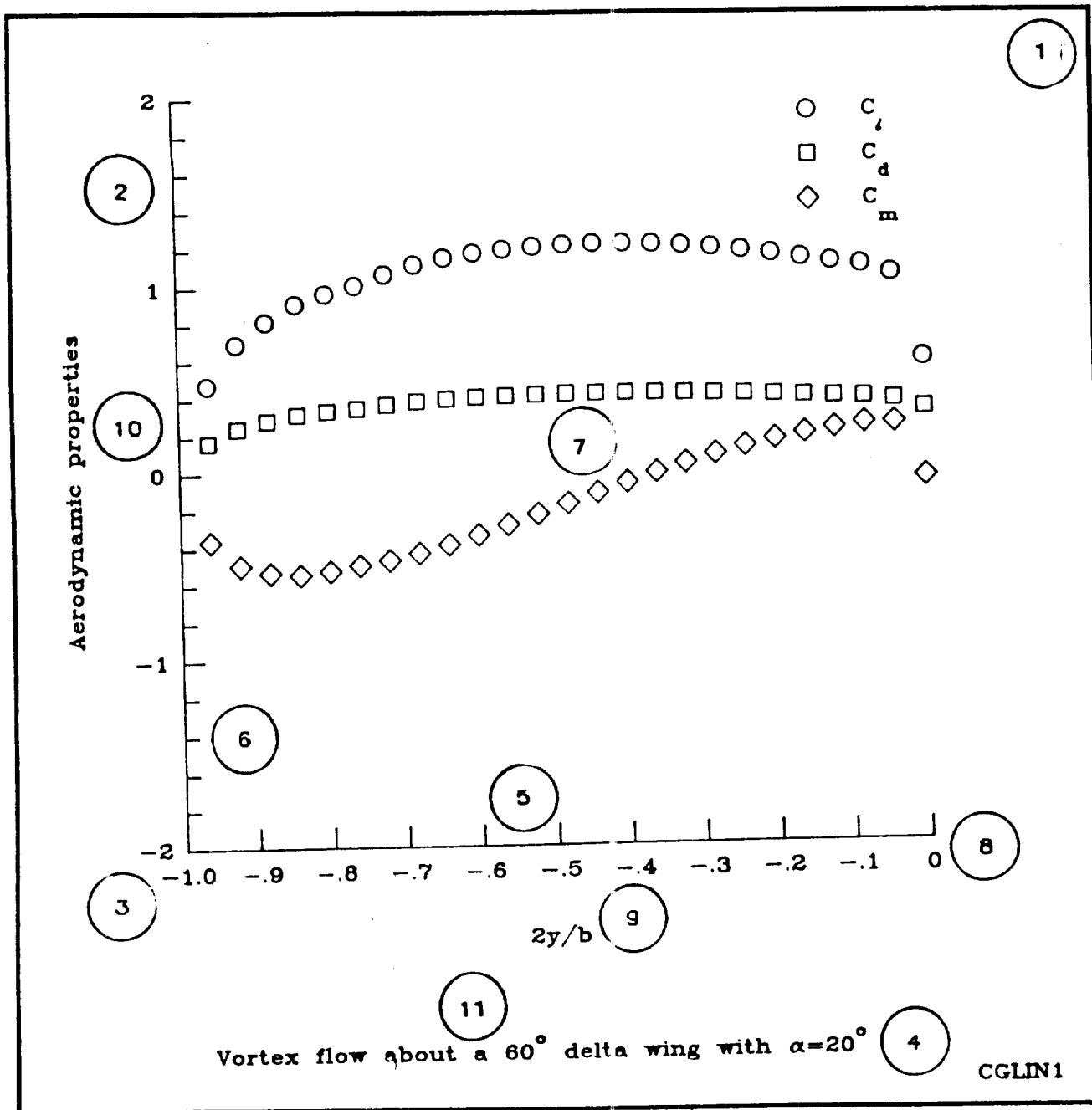


Figure C-1. Line and bar chart defaults.

<u>Characteristic</u>	<u>Default Value</u>
1) <u>page coordinates</u> -	7 by 7 units (can be thought of as inches)
2) <u>pie radius</u> -	$2/9 * \text{smaller page dimension (RADIUS)}$
3) <u>origin of pie</u> : XORIGIN - YORIGIN -	$1/2 * \text{page width}$ $1/2 * \text{page height}$
4) <u>character size</u> : height - width -	$.129 (\text{CHEIGHT}) **$ $8/10 * \text{character height (CWIDTH) **}$ Subscripts and superscripts are $8/10 * \text{base character height and width. **}$
5) <u>radial distance from origin to start of segment pointer</u> -	$\text{RADIUS} * 1.06$
6) <u>radial distance from origin to end of segment pointer</u> -	$\text{RADIUS} * 1.18$
7) <u>radial distance from origin to closest segment label</u> -	$\text{RADIUS} * 1.25$
8) <u>position of caption</u> : X-position - Y-position -	$1/2 * \text{XORIGIN}$ $\text{bottom of page} + 2 * \text{CHEIGHT}$

** Scale factor used in this expression is a ratio of publication standard defaults.

The following figure illustrates the various defaults for the line and bar charts.

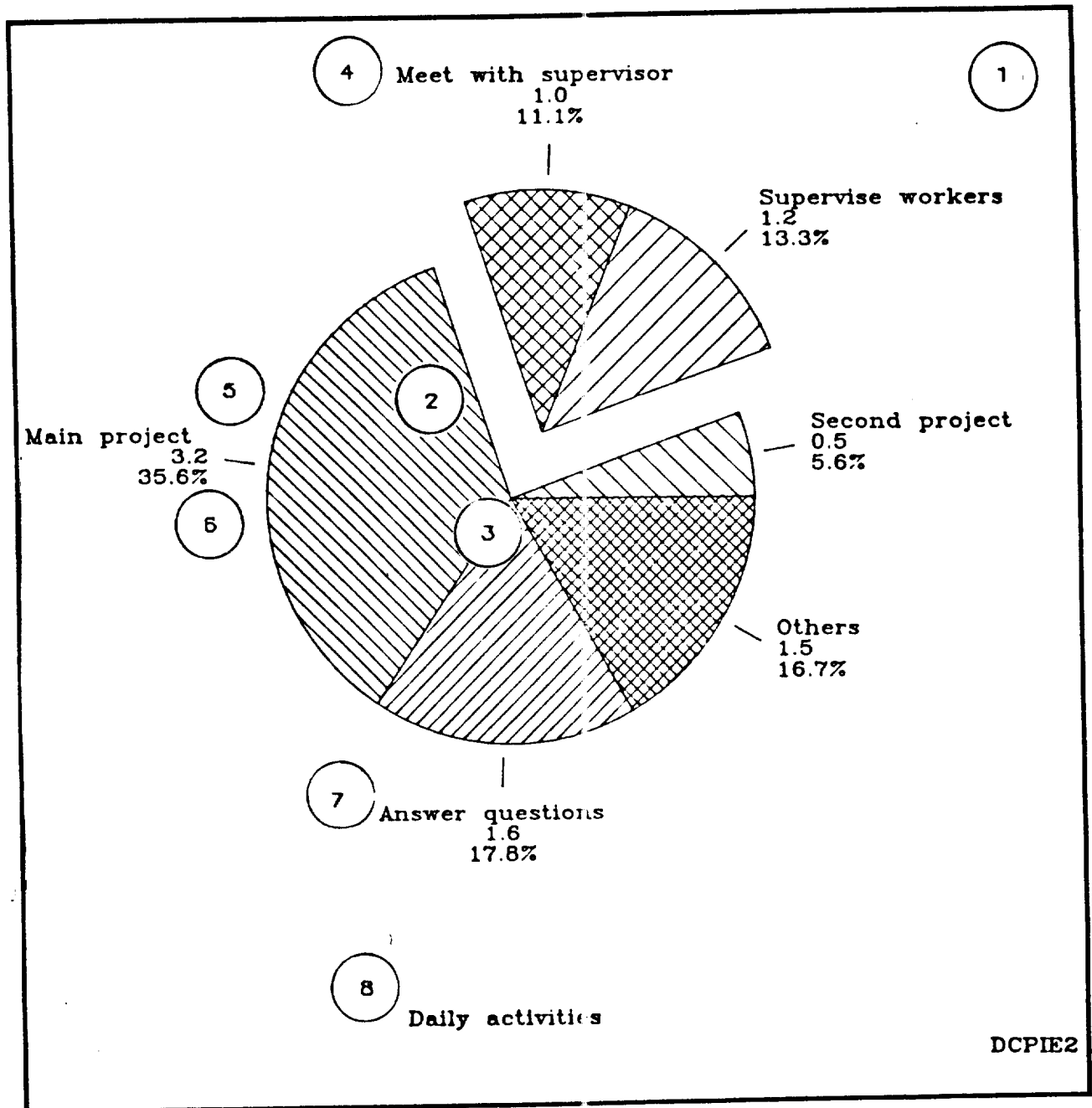


Figure C-2. Pie chart defaults.

Notes.

APPENDIX D

HOW TO ACCESS AND EXECUTE THE COMMON GRAPHICS LIBRARY

This appendix explains how to access and execute the CGL on several computer systems. It contains the following sections:

1.0 Accessing the Common Graphics Library on NOS	2
1.1 Manual Load Sequence	2
1.2 Batch CCL Procedure	3
2.0 Accessing the Common Graphics Library on PRIMOS	4
2.1 Load Sequence Using Unshared Versions of DI-3000	4
2.2 Load Sequence Using Shared Version of DI-3000	5
3.0 Accessing the Common Graphics Library on VAX	6
4.0 Accessing the Common Graphics Library on NOS/VE	8
4.1 Manual Load Sequence	8
4.2 Procedure to Run the CGL on NOS/VE	9

Any FORTRAN 77 code will be able to access the LEZ routines which currently use the DI-3000 based CGL. The CGL does not contain any PVI software; therefore, the device drivers, DI-3000 library, extended library, and any other DI-3000 based software must be loaded with the CGL. The user should consider the CGL as an extension of their graphics program. Because NOS and PRIME are ACD supported systems, procedures for these machines are given in this section. As the CGL is moved onto other ACD supported systems, this section will be expanded.

1.0 Accessing The Common Graphics Library On NOS

The CGL is available as a user library under the user number UN=LIBRARY. It may be accessed and loaded manually in a job stream or terminal session. There are also Cyber Control Language (CCL) procedures to facilitate both batch and interactive operation of the CGL.

1.1 Manual Load Sequence

Metafile Driver LOAD/EXECUTE Sequence (NOS)

```
ATTACH,DI3000,DIERFN,MFNODE,SSDUMMY,DD4014/UN=LIBRARY.  
ATTACH,DICOMLB/UN=LIBRARY.  
LDSET,LIB=DI3000/DICOMLB,MAP=N.  
LOAD,MFNODE,SSDUMMY,DD4014.  
LGO.
```

NGS LOAD/EXECUTE Sequence

```
ATTACH,DI3000,DIERFN,MFDUMMY,SSDUMMY,DD=DD4014/UN=LIBRARY.  
ATTACH,DICOMLB/UN=LIBRARY.  
LDSET,LIB=DI3000/DICOMLB,MAP=N.  
LOAD,MFDUMMY,SSDUMMY,DD.  
LGO.
```

1.2 Batch CCL Procedure

There are two batch procedures to run the CGL. The first procedure uses the standard NOS load sequence and is called CGLGO. The second, called CGLCGO, uses the capsule loader version of DI-3000. Their usage is given below:

```
GET,CGLGO/UN=PVINFO.  
CGLGO,DRIVER,MF,SS,ACCOUNT.
```

Where:

- DRIVER - the device driver to be loaded.
- MF - the metafile (omit if none is desired)
- MFNODE - if one is desired.
- SS - use the extended version of DI-3000
- ACCOUNT- ACCOUNT other than LIBRARY (not recommended unless a special driver is used.)

```
GET,CGLCGO/UN=PVINFO.  
CGLCGO,LGO,DRIVER,MF,SS,ACCOUNT.
```

Where:

- LGO - the relocatables of the user's program.
- DRIVER - the device driver to be loaded.
- MF - the metafile (omit if none is desired)
- MFNODE - if one is desired.
- SS - use the extended version of DI-3000
- ACCOUNT- ACCOUNT other than LIBRARY (not recommended unless a special device driver is used).

2.0 Accessing The Common Graphics Library On PRIMOS

The CGL is available as a user library on the PRIME network. The CGL pathname is:

PVI.INFO>CGL>DICOM.LIB

and it is located on the M machine. The user can use the load sequences below to build CPL files to create and execute a SEG file for a CGL application program. These sequences can also be performed manually.

The following assumptions hold for all the load sequences in this section:

- 1) application program resides on a file named TEST.F77.
- 2) all programs compiled using F77 compiler (i.e., F77 TEST).
- 3) target device is Tektronix 4014.

2.1 Load Sequence Using Unshared Versions of DI-3000

```
SEG -LOAD
ST 177774 (OPTIONAL)
LO TEST
LO PVI.INFO>CGL>DICOM.LIB
LI DIBASIC
LI DD4014
LI VAPPLB
LI
Q
```

To execute:

SEG TEST

2.2 Load Sequence Using Shared Version of DI-3000

```
SEG -LOAD  
ST 177774 (OPTIONAL)  
LO TEST  
LO PVI.INFO>CGL>DICOM.LIB  
LI D13.SHR  
LI VAPPLB  
LI  
Q
```

To execute:

```
SEG TEST
```

All conventions for using the shared version of DI-3000 (WHOAMI, metafiles, etc.) remain unchanged. See Section 7.1.4.2 of the Graphics Mini-Manual (Central Scientific Computing Complex Document G-1) for complete details.

3.0 Accessing The Common Graphics Library On Vax

Several VAX machines on the field have the CGL available to the users. The load sequence below can be used either in a .COM file or entered interactively.

The following assumptions hold for the given load sequence:

- 1) application program resides on a file of the form XXX.FOR.
- 2) all programs are compiled by executing the command FOR XXX, where XXX is the XXX.FOR file from 1).
- 3) the target device is a Tektronix 410X series terminal.

The load sequence is:

```
LINK 'P1' -  
Dxxx:[CGL directory]DICOM.OLB/LIBRARY -  
Dyyy:[DI3000 directory]DILIB.OLB/LIBRARY -  
Dyyy:[DI3000 directory]DDR405.OBJ -  
Dyyy:[DI3000 directory]MFNODE.OBJ -  
Dyyy:[DI3000 directory]DIMFLIB.OLB/LIBRARY -  
Dyyy:[DI3000 directory]UTILLIB.OLB/LIBRARY -
```

where:

- | | | |
|------------------|---|----------------------------------------------------------------|
| 'P1' | - | XXX from 1) and 2) above |
| Dxxx | - | disk where the CGL directory resides |
| Dyyy | - | disk where the DI3000 directory resides |
| CGL directory | - | pathname to the CGL files |
| DI3000 directory | - | pathname to the DI3000 files |
| DICOM.OLB | - | CGL code (executables) |
| DILIB.OLB | - | DI3000 code |
| DDR405.OBJ | - | device driver |
| * MFNODE | - | metafile device driver |
| * DIMFLIB.OLB | - | library containing I/O routines for the Metafile device driver |
| UTILLIB.OLB | - | library containing utility routines for DI3000 |
- * These two files need not be included in the load sequence if the metafile is not used.

NOTE: Since there is no centralized control over the different VAX machines on the field, the exact pathnames and filenames may be different from machine to machine. The system administrator for the user's machine should be contacted for specific directory and file information.

4.0 Accessing The Common Graphics Library On NOS/VE

The CGL may be accessed and loaded manually in a job stream or terminal session. There is also a procedure to facilitate both batch and interactive operation of the CGL.

4.1 Manual Load Sequence

The Common Graphics Library may be manually loaded using the CREate_Object_Library utility with the following sequence:

```
CREate_Object_Library
  ADD_Modules Library="object file"
" IF using di_textpro THEN "
  SATisfy_External_References ..
    Libraries=($family.library.graphics.common_graphics_library
              _textpro)
" IF not THEN "
  SATisfy_External_References ..
    Libraries=($family.library.graphics.common_graphics_library)

GENerate_Library Library="revised binary file"
QUIT

" Run DI-3000 procedure using the revised binary file. "
```

4.2 Procedure to Run the CGL on NOS/VE

Procedure to run the Common Graphics Library on NOS/VE is as follows:

"NOS/VE uses double quotations to denote comments."

"Acceptable abbreviations are shown in CAPITAL letters."

```
SET_Command_List Add=:ve1.library.graphics.procedure_library
" This may be done in the user prolog. "
```

```
EXEcute_Common_Graphics_Library ..
  Binaries="file default = $local.lgo"
Device=$REQUIRED
EXTended="boolean default=false"
MetaFile="boolean default=false"
ConTouring="boolean default=false"
Di_Textpro="boolean default=false"
status="status"
```


List of References

The following list of references are denoted by:

G-x refers to the ACD document series.

G-1 GRAPHICS MINI MANUAL (September 1985)

G-2 Guidelines in Preparing Computer-Generated Plots for
NASA Technical Reports with the LaRC Graphics Output
System (NASA TM 81908 (revised), Aug. 1983)

G-3 Langley Graphics System (January 1983)

G-5 DI-3000 User's Guide (Version 4)

G-6 Metafile System User's Guide

G-7 GRAFMAKER User's Guide, Precision Visuals
Incorporated (PVI)

G-10 Device Driver Guides

NMI1020.1E NASA Langley Research Center Management Manual
(Paragraph 13b)

Notes.

2-3

Report Documentation Page

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16. Abstract <p>The intent of this report is to introduce and instruct the users how to use the Langley Easy (LEZ) routines of the Common Graphics Library (CGL). The LEZ routines form an application-independent graphics package which enables the user community to view data quickly and easily, while providing a means of generating scientific charts conforming to the publication and/or viewgraph process. A distinct advantage for using the LEZ routines is that the underlying graphics package may be replaced or modified without requiring the users to change their application programs. The library is written in ANSI FORTRAN 77, and currently uses a CORE-based underlying graphics package, and is therefore machine-independent, providing support for centralized and/or distributed computer systems.</p> <p style="text-align: center;">ORIGINAL PAGE IS OF POOR QUALITY</p>					
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